MODERN PLASTICS

mp

AUGUST 1946

FIVE BRANDS OF "IRONS"— ONE BRAND OF PLASTICS

These five electric irons — made by five different manufacturers — obviously differ from one another. Even the two "home" irons are dissimilar . . . each embodying its own special features.

The three soldering irons, of course, are vastly unlike, as you can easily see. However, all five have one thing in common . . . molded Durez handles. Why?

Special Properties Required

Heat resistance, of course, is absolutely essential. Dielectric strength is another property which these plastic handles must possess. Then there are several other characteristics — impact strength, pleasant "feel," and excellent moldability — which are also necessary to meet the exacting requirements of the manufacturers.

Durez Phenolics Are Versatile

All these properties . . . and many more . . . are inherent characteristics, in varying degrees, in every one of the more than 300 Durez phenolic molding compounds which have been scientifically developed during the past twenty-six years. They account for the wide use of Durez throughout the electrical manufacturing industry.

The manufacture of such products as radios, electric toasters, vacuum cleaners and telephones, for example, consumes many tons of Durez annually. Therefore, when it's a matter of handles . . or any of a thousand-and-one other items which require a really versatile material . . . make it a point to look to Durez first.

Experienced Assistance Available

A staff of experienced technicians plus a wealth of proved product development data, are available at all times to you and your custom molder. Durez Plastics & Chemicals, Inc., 58 Walck Rd., N. Tonawanda, N. Y. *Export Agents: Omni Products Corporation, 40 East 34th St., New York 16, N. Y.*

DUREZ

PHENOLIC RESINS

MOLDING COMPOUNDS

INDUSTRIAL RESINS

OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

The Finer the Kitchen Tool — The More Certain its Handle is *Catalin* . . . the Gem of Plastics

To the eye, Catalin is brilliant beauty . . . and an unmatchable richness of color. To the hand, Catalin's inherent qualities are further enhanced by staunchness, cleanliness and serviceability. These attributes, when allied with those of stainless steel, assure the utmost in kitchen tool satisfaction . . . for here, it is very essential that the *handle* end be as proficient as the *operating* end.

The Washburn Co. of Worcester, Mass., famed for their extensive line of "Androck" ware, use gem-like Catalin handles almost exclusively, knowing full well after many years of experimentation, that Catalin possesses definite over-the-counter sales appeal *plus* in-the-kitchen service advantages.

Catalin, the gem of plastics, will not soften when subjected to repeated washing. It is odorless, tasteless, non-inflammable, smooth and pleasing to the touch — never hot. When mounted over metal tangs, it will never twist, slip or work loose. Catalin *handles* itself gracefully and permanently!

As producer of the gem-like cast phenolics, polystyrene injection molding compounds, phenolic compression molding compounds and a host of thermoplastic and thermosetting liquid resins, we welcome the opportunity to sit in with product designers, engineers or manufacturers and their appointed fabricators or molders, at a time when creative pencils are busy. The selection of the right material, combined with advance discussions as to proper processing methods and mold or arbor design, can gain much from a before-hand meeting of minds. Inquiries invited!

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE, NEW YORK 16, N. Y.

CATALIN
THE GEM OF PLASTICS
Catalin

CAST RESINS · LIQUID RESINS · MOLDING COMPOUNDS

MODERN PLASTICS

VOLUME 23 AUGUST 1946 NUMBER 12

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Saddle and gear by All Western Plastics Co., Alliance, Neb.

HERE AT CMPC we're committed to just one job . . . and doing that job well. We have no products of our own. We have nothing to offer the dealer or jobber. Instead, all of the effort of our seasoned organization . . . all the facilities of our modern 3 acre plant . . . are devoted to the important task of producing good plastic parts for the manufacturers we serve.

Results have proved the wisdom of this policy. It has enabled us to give undivided attention to the needs of those we serve . . . to make their problems our problems . . . to become, in effect, the customer's plastics molding department. With an organization geared to custom molding exclusively . . . meshing our knowledge with that of our customers . . . giving them the full benefit of our quarter century of experience in plastics . . . assuming undivided responsibility for designing, mold making, molding, and finishing . . . we have built up a nationwide reputation for quality in molded plastics.

Right now is the time to make definite preparations for 1947 production . . . and we can serve you best by working with you while designs are still in their early stages. There is no obligation. Just ask for a CMPC Development Engineer.

Plastic **CHICAGO MOLDED PRODUCTS CORPORATION** *Molders*

1046 N. Kolmar Ave. Chicago 51, Illinois

Branch offices in principal industrial centers

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

EXECUTIVE AND EDITORIAL OFFICE:
122 E. 42nd St., New York 17, N. Y.

BRANCH OFFICES:
Chicago 1, 221 N. LaSalle St., Tel.: Randolph 5588
Cleveland 14, 815 Superior Ave., Tel.: Superior 0737
Los Angeles 13, 427 West 5th St., Tel.: Michigan 9849

Member Audit Bureau of Circulations

MODERN PLASTICS is regularly indexed in the Industrial Arts Index and in Industex.

The yen for a plastics business

"I wanna get in plastics!" The jangle is increasing in intensity by the hour. Fortunately, the field for plastics is large and comprehensive, and the industry would be foolish if it failed to properly utilize the public's curiosity concerning it. But the danger of a boomerang when inexperienced operators start turning out inferior products is vicious and far reaching.

It is apparent that hundreds of fledgling entrepreneurs are under the impression that all they have to do to cash in on this booming industry is to set up a press in an old garage and start turning out finished products. This office and many others in the industry receive scores of letters from street car conductors, carpenters, beehive makers, cheese producers, and from others in almost every imaginable calling who admit no knowledge of the subject but think plastics have a great future—who want to get in on the gravy train and how do you go about it?

This situation becomes even more cluttered up by the intervention of Congress, many of whose members insist that veterans and small businessmen, even though their background of plastics or chemistry is completely nil, must have a certain proportion of the available presses and raw material. The government is doing no veteran or small businessman a favor when it helps to set him up in a business about which he has no knowledge and little chance of success.

The plastics industry can have no legitimate excuse for keeping the field to itself—new blood is certain to come into this expanding enterprise. But industry leaders point out that the way to get into the business is by first gaining experience with a reputable firm. They are concerned about the harm that will come to all of them, including the newcomers, when green hands start producing inferior goods.

Plastics is no business for a novice. Poorly compounded vinyls that become tacky leave a poor impression upon a customer. A molded soap box or cigarette container warped out of shape irritates the user. A lamp shade designed like some monstrosity handed down from the days of Charlemagne adds no prestige to the plastics industry. It requires skill, experience and knowledge to produce satisfactory plastic products, just as it requires special knowledge to manage a bank, operate a farm or erect a building.

Production problems for plastics are severe and irksome. All important companies now boast of a highly trained chemical and engineering staff, for processors state that it's not *what* you use but *how* you use it that brings results. The proprietor of a one-man molding shop soon discovers that something more than a press and molding material are necessary. He finds that he can't do business for long on one mold, that molds are scarce and mold makers more so. He must have equipment to dry his molding material and more equipment to finish it. He can't make money knocking off gates with a file nor cutting them off with scissors.

Yes, the plastics industry is glamorous with great markets in prospect. But it is impossible to jump in the stream and keep afloat unless the jumper knows how to swim.

Universally popular 10D-8 Oz. model

RECOGNIZED LEADERSHIP

. . . Throughout the World!

From the crowded industrial centers in New England and the East to the fast developing Pacific Coast cities — across the Nation — throughout the World — wherever plastic materials are injection molded — you'll find Reed-Prentice installations predominate!

Such recognized supremacy constitutes a leadership not lightly viewed.

Records showing machines in use and on order, closely follow the chart of the plastic industry — Massachusetts, 201; New York, 295; New Jersey 189; Illinois, 190; California, 85 — characteristic of the engineering leadership Reed-Prentice is pledged to protect.

This complete line of models — 4, 6, 8, 12, 16 and 22 Oz. sizes — provides a choice that meets any injection molding requirement. Write NOW for complete information.

THE WORLD'S LARGEST MANUFACTURERS OF INJECTION MOLDING MACHINES

ARMY NAVY E

INJECTION
REED-PRENTICE CORP.
WORCESTER MACHINES MASS., U.S.A.

NEW YORK OFFICE:
75 West St., New York 6, N. Y.

CLEVELAND OFFICE:
1213 W. 3rd St., Cleveland 13, Ohio.

How Pills picked-up Plastics

A Kurz-Kasch idea for reducing loading time back in 1920, forming material into pre-forms or "pills," quickly came into universal use. Without it, early pre-heating and today's Heatronic techniques might never have proved practical.

SOMEONE always benefits *first* from every new idea in plastic molding—and plastics buyers in that happy position usually count their gains in dollars and cents.

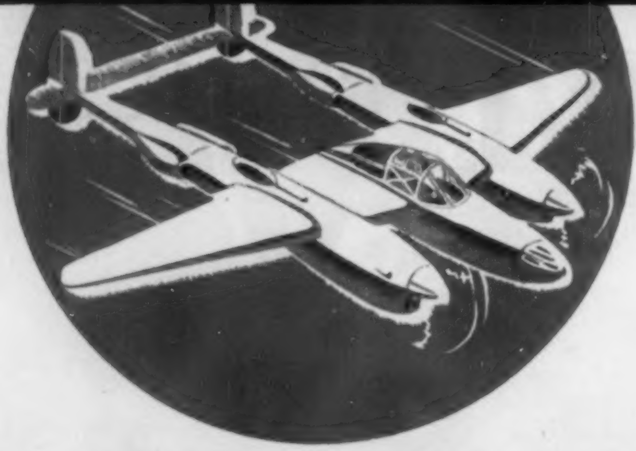
As this series of ads reveals, Kurz-Kasch customers have reaped these benefits for many years. If your problem is compression or transfer molding—if you want to take advantage *today* of *tomorrow's* bright ideas—let us tell you about Kurz-Kasch's molding facilities. Send for your Free copy of our booklet, "A Businessman's Guide to the Molding of Plastics."

Kurz-Kasch

For Over 29 Years Planners and Molders in Plastics

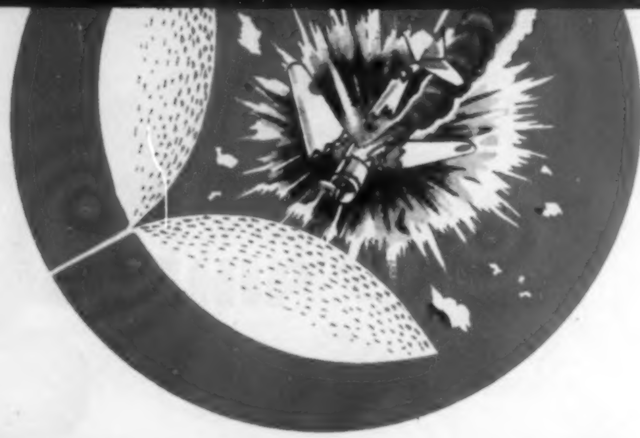
Kurz-Kasch, Inc., 1415 S. Broadway, Dayton 1, Ohio. *Export Offices.* 89 Broad Street, New York, N. Y.
Branch Sales Offices: New York • Chicago • Detroit • Los Angeles • Dallas • St. Louis • Toronto, Canada.

WE HELPED KEEP OUR BOYS FLYING . . .



One of our important war jobs was molding parts for airplane ignitions . . . a job where craftsmanship, modern equipment, and scientific know-how played leading roles.

AND HELPED CLEAR THE SKIES OF KAMIKAZE PLANES



While not claiming that we won the war, we are proud of our share in making the Proximity Fuze. The Navy gives a good deal of credit to this Secret Weapon No. 2, for stopping Jap suicide planes.

WE CAN HELP YOU WITH YOUR PLASTICS PROBLEMS, TOO!

PROLON PLASTICS

We have the equipment (modern, up-to-date machines and presses) . . . we have the craftsmen (skilled labor experienced in turning out work to meet the exact specifications and rigid standards of the Armed Forces) . . . we have our own planning and mold-making departments (to save you money by practical, workable, *and economical* designs!) . . . we have the experience (100 years in the plastic business). Let our research engineers figure out your plastic problems . . . large or small.

A Division of* PRO-PHY-LAC-TIC *Brush Co., Florence, Mass.

TO USERS AND PROSPECTIVE USERS OF PLASTIC MOLDINGS

GRABBING FOR THE BRASS RING? ARE YOU?

WANT A FREE RIDE?

WE'LL GIVE YOU ONE— TO BOONTON

Most of the current information about the current plastics is found in our little handbook "A Ready Reference for Plastics." You may have a copy free by writing for it.

Just phone our New York office and ask for the Guided Tour Department. They will arrange a trip through the factory.

Should you be too busy for a day in the country, the folks in the Chanin Building are fully competent to discuss design for molding—and, by the way—if urged, will push the button on our automatic projection machine so you can see the factory, on film, in color, while resting comfortably in an armchair.

ARMY E NAVY

BOONTON MOLDING COMPANY

MOLDERS OF PLASTICS • PHENOLICS • UREAS • THERMOPLASTICS

122 EAST 42nd ST., NEW YORK 17 • MUrray Hill 6-8540

FACTORY—BOONTON, NEW JERSEY


DOMINANT from the ROCKIES to the SEA
Located in sunny California, American Extruded Products serves the entire country, but especially the West Coast. We do nothing but extrude plastics—all kinds, all shapes and sizes. We have the largest plant on the West Coast devoted to this type of work. We have been serving Western industry with many types of work. We handle their custom requirements, working with their engineers and production men. We maintain a large assortment of extruded stock items such as rods, tubes, tapes and profiles which are available for immediate delivery.
The consumer knows us, too, for our unusual applications for the home. Plastic garden hose — made of vinyl — 1/3 as light as rubber and much longer-lived — is one of our contributions to better living. Bright-colored shelf edging is die-stamped from extruded strips into a colorful kitchen commodity which the housewife finds especially attractive.
For these and for many other reasons, American Extruded Products leads the West Coast—and is gaining a national reputation in extruded plastics.
AMEPCO
FLEXIBLE
RIGID
DURABLE
LOS ANGELES
AMERICAN EXTRUDED PRODUCTS CO.
1001 N. LaBrea Avenue
Hollywood 38, California

MEETING A RIGID TEST

...practically zero deflection under full load

The 450-ton Lake Erie Hydraulic Press illustrated meets this exacting requirement. For even the slightest deflection of the press platens under full load would damage the laminated panels produced by Fabricon Products, Inc. of Detroit, Mich.

★ ★ ★

Rugged construction is but one of the many features of all Lake Erie Hydraulic presses. For example, in producing Fabricon Laminated Panels, accuracy of control is equally vital. The necessity for exerting and maintaining pressures in an exact range with variable rates of closing and opening are other requirements that had to be met. These requirements are fully realized...automatically...by the press illustrated. For once the molding cycle is started, the press automatically closes, turns on the steam in the press platens, cuts off the steam, turns on water cooling circuits, and opens at the proper time interval for removal of the laminated panels.

No matter what features you are looking for in a press...sturdy construction, precision control, reliable operation...you will find all of them in Lake Erie Hydraulic Presses. A complete range of types and sizes is available for molders...compression molding presses, duplex molding presses, multiple-unit molding presses, laboratory and test presses ...self-contained or accumulator operated. Consult Lake Erie about your specific press needs or write today for Hydraulic Press Bulletin 544. No obligation, of course.

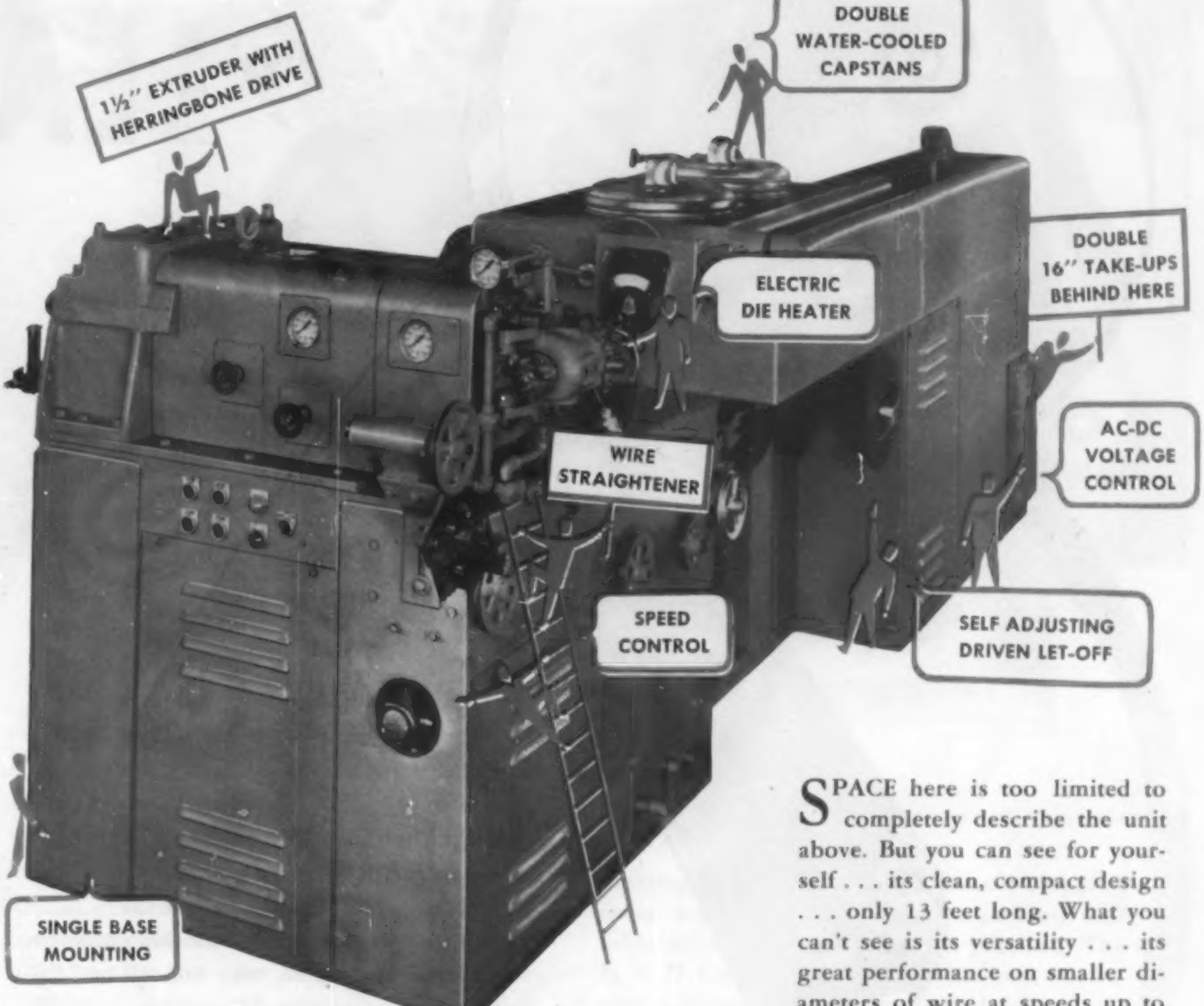
LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE
ENGINEERING CORPORATION
868 Woodward Avenue, Buffalo 17, N. Y.
Offices in Principal Cities and Foreign Countries

Leading manufacturer of hydraulic presses —all sizes and types—plastic molding... metal working...processing...rubber vulcanizing...stereotyping...special purpose.

Any way you look at it...

This 1½" NRM Wire Covering Unit Sparkles With Features



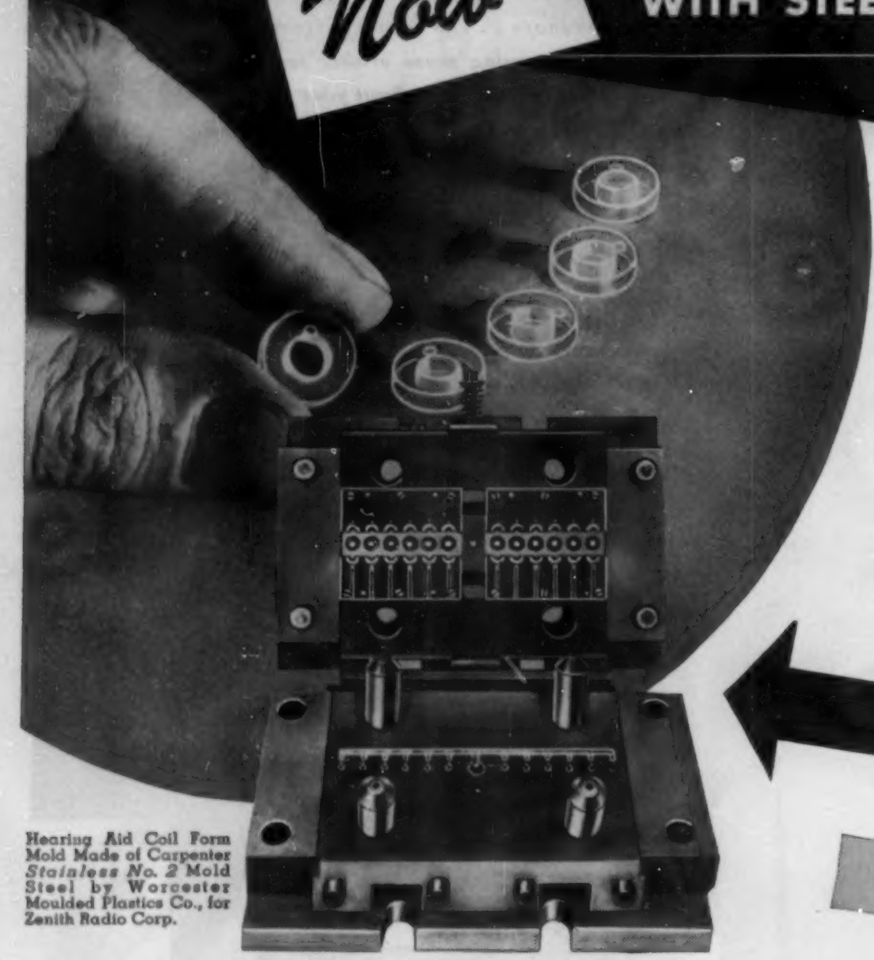
SPACE here is too limited to completely describe the unit above. But you can see for yourself . . . its clean, compact design . . . only 13 feet long. What you can't see is its versatility . . . its great performance on smaller diameters of wire at speeds up to 800 feet a minute. If you want to add a great little unit to your wire covering capacity, you'll need more information of course . . . just drop us a line, today.

NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION

Now—

CUT MOLD MAKING COSTS WITH STEELS THAT GIVE YOU



Hearing Aid Coil Form Mold Made of Carpenter *Stainless No. 2* Mold Steel by Worcester Moulded Plastics Co., for Zenith Radio Corp.

LONG PRODUCTION RUNS

MIRROR FINISHES

EASY MACHINING AND HOBBING

CORROSION RESISTANCE

HARDENING ACCURACY

MAXIMUM STRENGTH

EXTRA WEAR RESISTANCE

Suppose you were faced with the job of making these plastic coil forms with walls only .010" thick. First, tolerances were very close. Second, the job required a mold steel that would maintain its accuracy in hardening and one that would not "give" or distort under terrific pressure and heat. Then too, absolute protection against corrosion was vital. Carpenter *Stainless No. 2* Mold Steel not only met the above requirements but provided smooth, lustrous finishes over long runs . . . *with less time required for re-polishing mold cavities!*

This job shows what CAN be done when the expert mold maker teams up with clean, sound Carpenter Mold Steels. So get in touch with your nearby Carpenter representative today. You'll find his experience a great help in solving your problem of cutting mold costs.

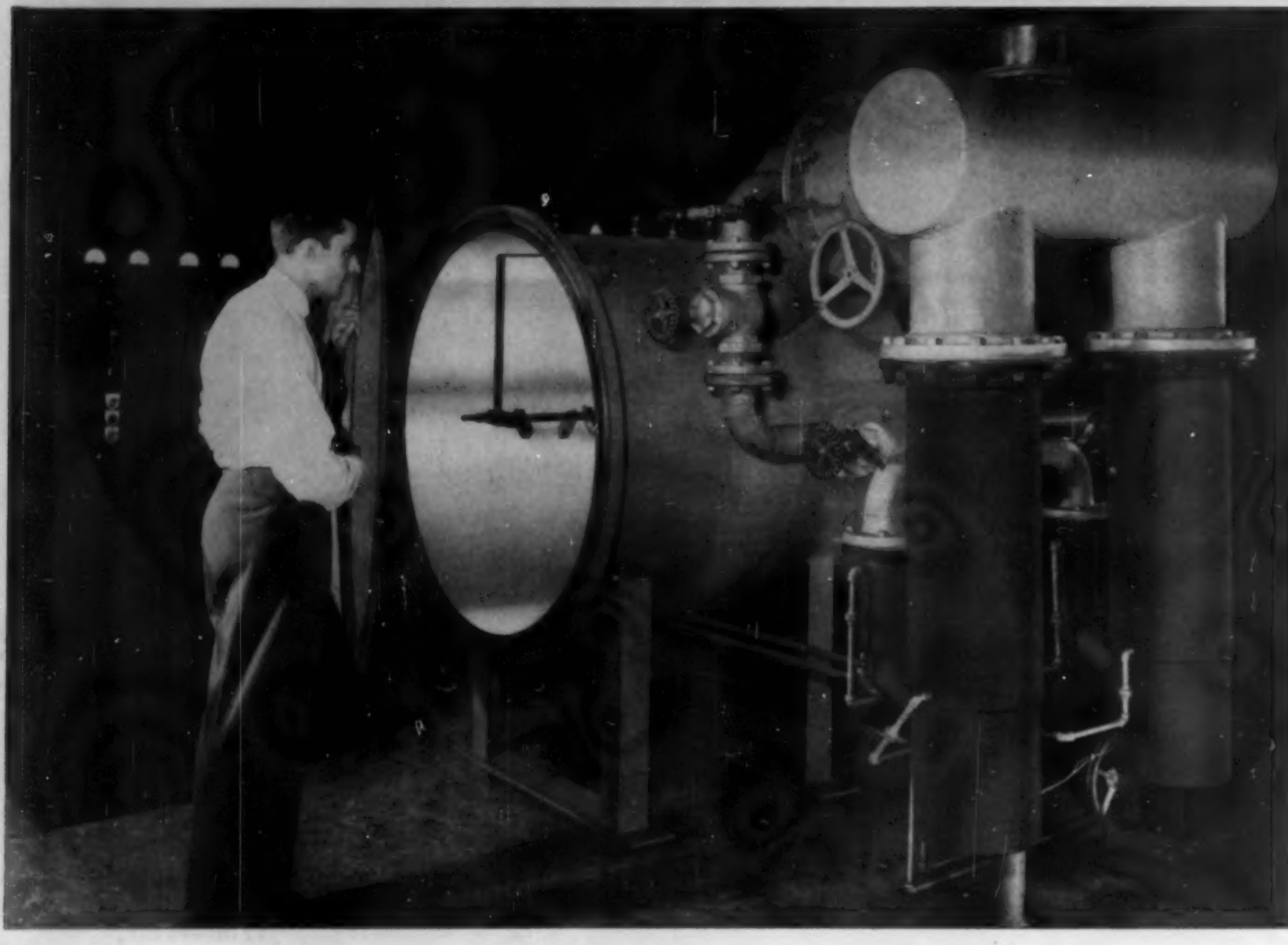
THE CARPENTER STEEL CO., 112 W. BERN ST., READING, PA.

For useful information on how to select the right steel for your job, send for the free, 36-page book "Tooling Up For Plastics". A note to us on your company letterhead, indicating your title, is all that's required. Write today.

AVAILABLE FROM COMPLETE STOCKS . . .

Carpenter GUARANTEED CLEAN DIOK SOUND UNIFORM
ELECTRIC FURNACE MOLD STEELS
100% ACID DISC INSPECTED

In Conveniently Located Warehouses: Buffalo, Chicago, Cincinnati, Cleveland, Dayton, Detroit, Hartford, Indianapolis, New York, Philadelphia, Providence, St. Louis



Are You Interested In

DECORATIVE COATINGS ON PLASTICS?

You can evaporate mirror-like metal films on plastic pieces in your own plant.

High production and low cost are built into the INDUSTRIAL HIGH VACUUM COATING UNIT TYPE NO. 3103.

This new application of a standard process is made possible by this outstanding new development in High Vacuum Equipment.

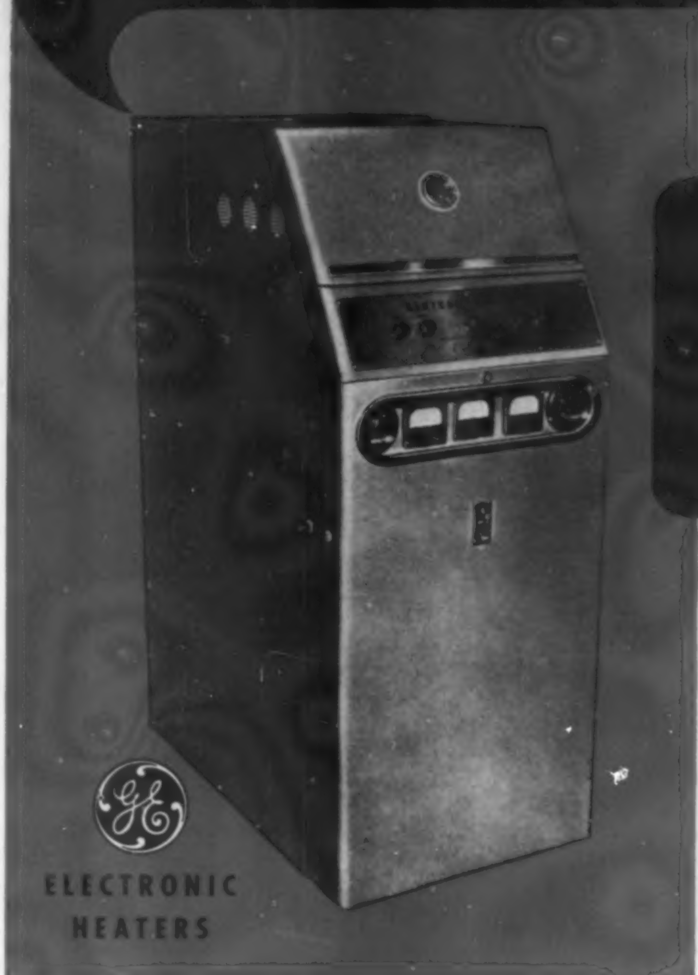
Please write for complete details. VACUUM ENGINEERING DIVISION, National Research Corporation, Boston 15, Massachusetts.

HIGH VACUUM FOR INDUSTRY

NATIONAL RESEARCH CORPORATION

Vacuum ENGINEERING DIVISION

DESIGNED TO THE PLASTICS INDUSTRY'S REQUIREMENTS



THE NEW G-E PLASTICS PREHEATER

Here are the requirements that a leading plastics manufacturer prescribed for an *electronic* plastics preheater:

- *FAST HEATING*
- *SIMPLIFIED OPERATION*
- *STURDY CONSTRUCTION*
- *MINIMUM FLOOR SPACE*
- *EASY MAINTENANCE*
- *PORTABILITY*
- *AUTOMATIC COVER*
- *TWO TIMERS*

5 Kw, 40 Megacycles . . . for Faster Preheating*

G.E.'s new plastics preheater is designed to meet all these requirements. Its 5-kw output and 40-megacycle operation (by means of a watercooled oscillator tube) provide faster heating, stepping up production. With a sturdy construction for heavy-duty industrial use and accessibility for easy maintenance, repair costs are kept down—its compact design ($49\frac{5}{16}$" h x $19\frac{1}{2}$" w x $33\frac{11}{32}$" d) and portability features permit it to be placed conveniently between two presses. And with its simplified operation and automatic cover, increased operating efficiency is made possible.

● Add up the important advantages you obtain by installing the new G-E preheater in your shop: Accelerated Production + Low Maintenance + Greater Operating Efficiency = *Increased Plastics Production at Lower Unit Cost.*

There's a heating specialist located in a G-E Office near you. He will be glad to supply you with information on this new preheater, as well as advise you on the selection of electrical equipment for all types of heat-treating processes. Or, mail the coupon below.

* For example, this new preheater will heat one pound of wood-flour phenolic compound from 70° F to 250° F in 12 seconds.

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY,
Sec. 675-136
Schenectady 5, N. Y.

............Please send me Announcement GEA-4623, which describes the new fast-heating 5-kw Electronic Preheater.

............Please have a heating specialist contact me at the earliest opportunity.

Name..

Company..

Address..

City.................................... State ....

Light-weight NIXON E/C Makes Light Work of Mixing

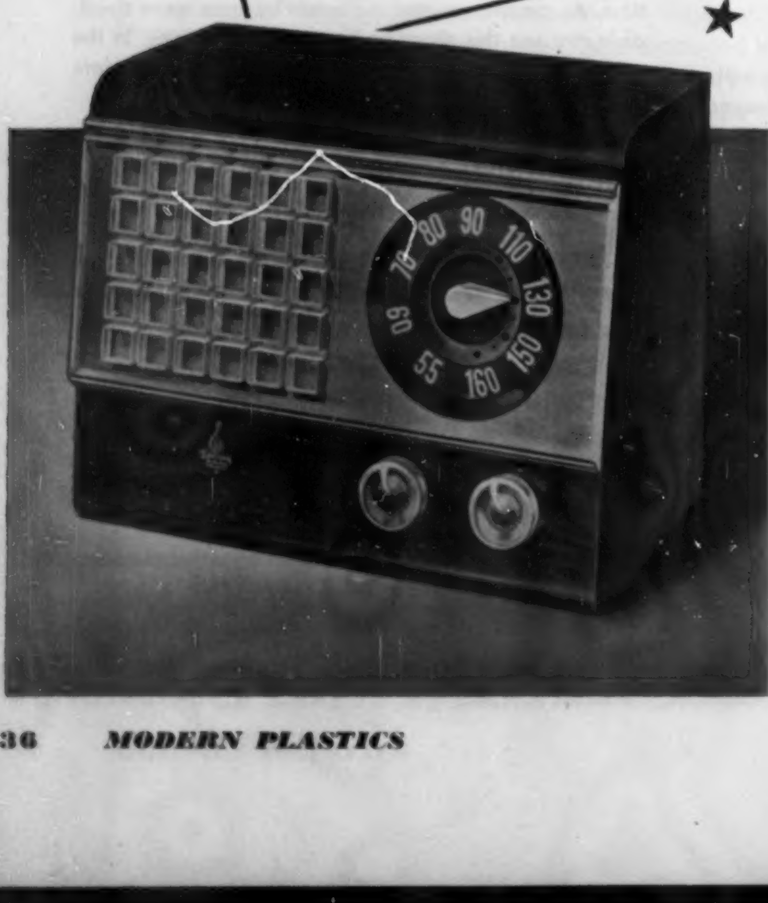
C/N
CELLULOSE NITRATE

C/A
CELLULOSE ACETATE

E/C
ETHYL CELLULOSE

Watch 1946 brides . . . and those of 1916 too . . . go for the new A. C. Gilbert's Whirlbeater. It weighs only 30 ounces . . . it fits a woman's hand as easily as a spoon . . . and it's portable. Old style beaters and mixers are too heavy, too awkward to handle. With the Whirlbeater you pick it up, flip the switch and whip up a bowl of mashed potatoes or scrambled eggs quicker than you can say "NIXON E/C (Ethyl Cellulose)", the plastic material from which the housing is molded. Just another smart use of a Nixon Plastic. Keep Nixon in mind in connection with your plastic requirements.

NIXON NITRATION WORKS
NIXON • NEW JERSEY



Economy and Utility—
IN PLASTICS AND METALS
The range of products and parts where plastic and metals can be combined to decided advantage is growing rapidly . . . costs are cut . . . streamlined design becomes practical . . . color can be readily incorporated. For instance, this Auto-Lite distributor cap assures the highly important precision positioning of the metal contacts, provides a high insulation factor, gives low-cost construction . . . and even this utilitarian item shows the modern color eye appeal possible through plastics. The nipples are plastic, too, in a material which resists both ozone and oil in breakdown tests far surpassing any normal field conditions.
Distributor cap of plastics and metals, nipples of Elastomeric plastic, together with distributor and spark plug wires; all precision manufactured by Auto-Lite.
See our catalog in Sweet's File for Product Designers.
THE ELECTRIC AUTO-LITE COMPANY
Bay Manufacturing Division
Detroit 2, Michigan
Bay City, Michigan
Auto-Lite
Tune in the Auto-Lite Radio Show Starring Dick Haymes
Every Thursday Night, 9:00 P.M.—E.T. on CBS
AUTO-LITE MEANS PRECISION MANUFACTURING

light weight

chemical resistance

dimensional stability

low-temperature strength

COLOR AND TRANSLUCENCE

excellent electrical properties

LOW COST

Specify

LUSTRON

Beauty and style . . . mass-produced . . . for mass sales.

Those eight words do more than describe these smart salad sets molded by Standard Products, St. Clair, Michigan. They also outline one of the biggest opportunities Lustron opens up to alert manufacturers.

With Lustron, Monsanto's versatile polystyrene, you get a combination of luxury appearance with low cost that no other type of plastic can match. You get a lustrous, gem-like surface in your product and you have rainbow-wide range of clear, sparkling colors to choose from. Yet Lustron's low cost per pound, light weight, and adaptability to the fastest, most efficient molding techniques make it the most economical of all thermoplastics to use.

If you would like to reach a mass market with mass-produced beauty and style . . . or if you have a specialized problem where the many other superiorities of Lustron listed above will be useful . . . write, wire or phone for technical data, samples and further information. MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts. In Canada, Monsanto Canada, Ltd., Montreal, Toronto, Vancouver.

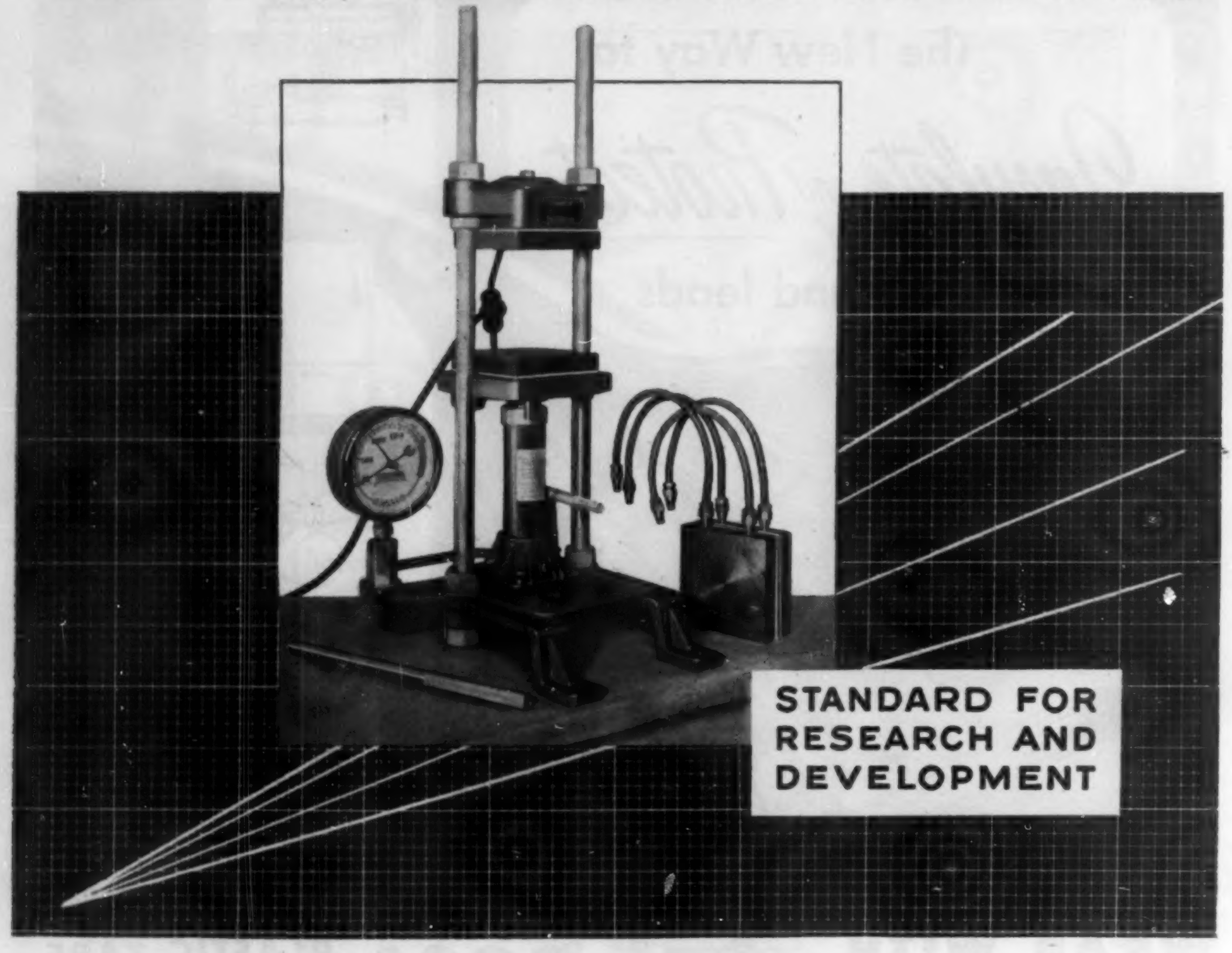
The broad and versatile Family of Monsanto Plastics includes: Lustron* polystyrenes Cerex* heat resistant thermoplastics Vinyl acetals • Nitron* cellulose nitrates Fibestos* cellulose acetates • Thalid* for impression molding • Resinox* phenolics Resimene* melamines • Forms in which they are supplied include: Sheets • Rods • Tubes Molding compounds • Industrial resins Coating compounds • Vuepak* rigid, transparent packaging materials.

*Reg. U. S. Pat. Off.

MONSANTO PLASTICS

SERVING INDUSTRY... WHICH SERVES MANKIND

THE CARVER LABORATORY PRESS



Foremost among the aids in plastics development is the Carver Laboratory Press. This small, powerful press is just what you need for your research program. Accurately controlled pressures up to 20,000 lbs. are produced quickly and smoothly by hand operated lever. In chemical and plastics research the Carver press performs countless tasks.

•

Carver Laboratory Press accessories include electric and steam hot plates and test cylinders.

Additional Carver interchangeable equipment includes swivel bearing plates, cage and filtering equipment, etc. The press and various of the accessories are patented. Send for latest catalog describing Carver Press equipment and indicating many uses. Prompt deliveries.

MANY important developments in plastics have originated from research and experimental work conducted with the Carver Laboratory Press. Recognized by its characteristic design, this press has been standard equipment in plastics laboratories for 16 years. It is useful and dependable

- **for making quick and accurate small-scale pressing tests.**
- **for development, research and instruction work.**
- **for testing single cavity molds.**
- **for preparation of samples.**
- **and even for small-scale production.**

The Carver Laboratory Press is small, compact,

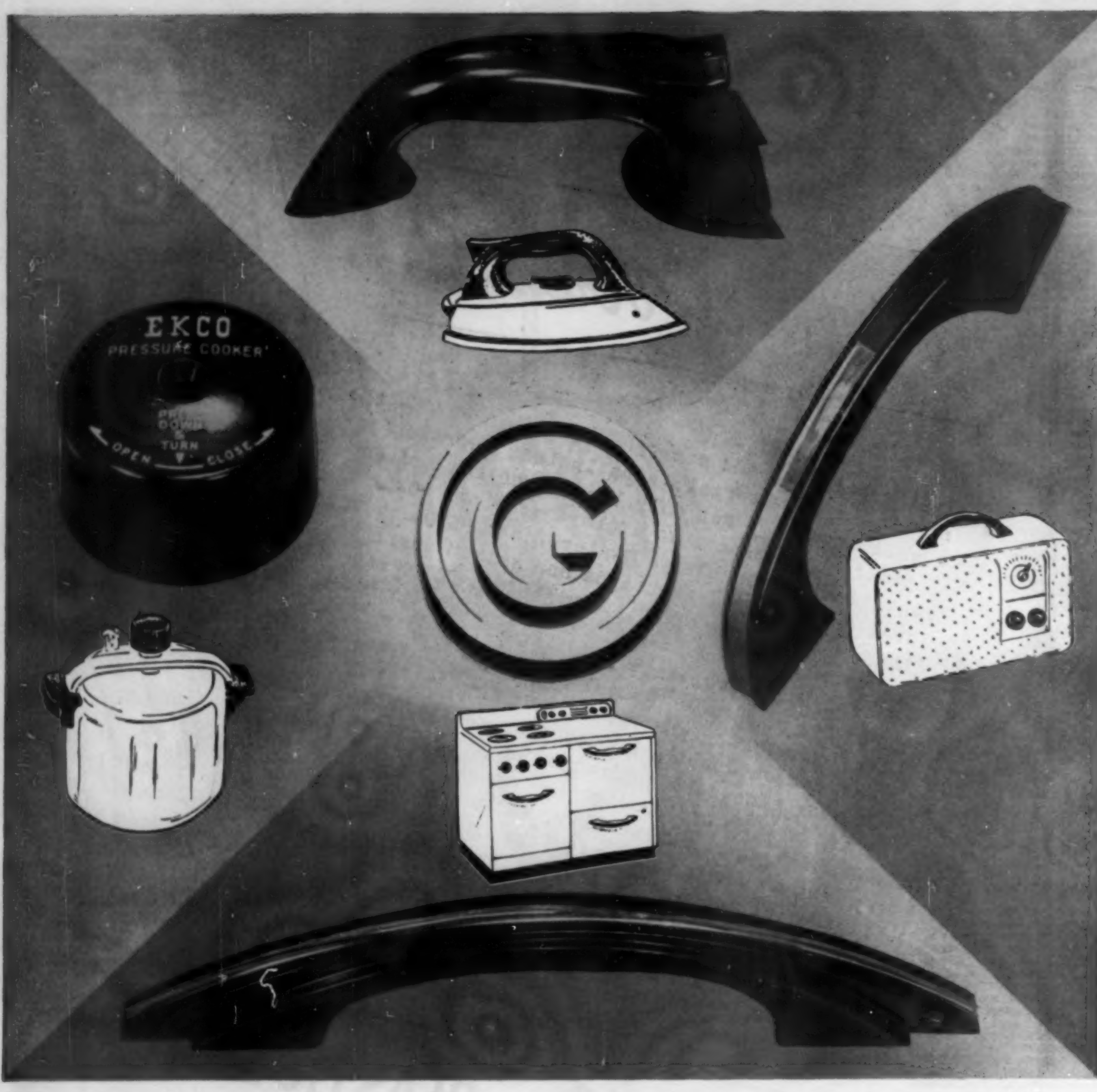
- **has a pressing capacity of 20,000 lbs.**
- **weighs only 125 lbs.**
- **operates under self-contained hydraulic unit, giving any precise variations in pressure that may be desired.**
- **large accurate gauge of finest construction is rigidly mounted on base.**
- **special gauges are available for low pressure work.**

FRED S. CARVER

HYDRAULIC EQUIPMENT

343 HUDSON STREET • NEW YORK 14


PLYON is Versatile...
In the building and construction field PLYON, the new laminate material, wins instant approval as a wall covering. Not only because of its "color appeal", but because it is hard wearing, acid resistant...washable yet waterproof. PLYON is the ideal answer for drainboards and splash surfaces. PLYON, too, is perfect for lampshades. PLYON may be opaque or translucent in a variety of patterns and colors. Its wearability and ease of cleaning makes for plus sales appeal for table tops, table mats, counters...yes, even for umbrellas, rain-coats and outdoor furniture that gets tough wear yet must always look "dressed up". PLYON can take it and still give Sunday-best appearance.
And speaking of versatility, we've developed PLYON to meet a wide range of requirements from complete rigidity to complete flexibility. Moreover, PLYON bonds easily and permanently to other surfaces. Perhaps you have an application you would like to discuss with us? Drop us a line and tell us about it.
Swedlow-PLASTICS CO.
(CREATORS OF PLYON)
5527-33 District Blvd.
Los Angeles 22, Calif.



For Versatility in Plastic Molding you can depend on GRIGOLEIT

For 19 years we've supplied many nationally prominent manufacturers with parts and trim for their products. The *versatility* of our facilities and our molding experience enable us to create unusual design or standard plastic items.

For reasonably early availability, we offer an extensive "standard" line of handles, knobs and other parts for stoves, furniture and household appliances; also a large "stock" line of closures for foods, drugs and cosmetics.

We also maintain a complete custom-molding service in thermo-plastic and thermo-setting plastics. Operating our own metal and tool shops, we are able to insure perfect blending of plastics and metal.

Write for 1946 Catalog

THE GRIGOLEIT COMPANY

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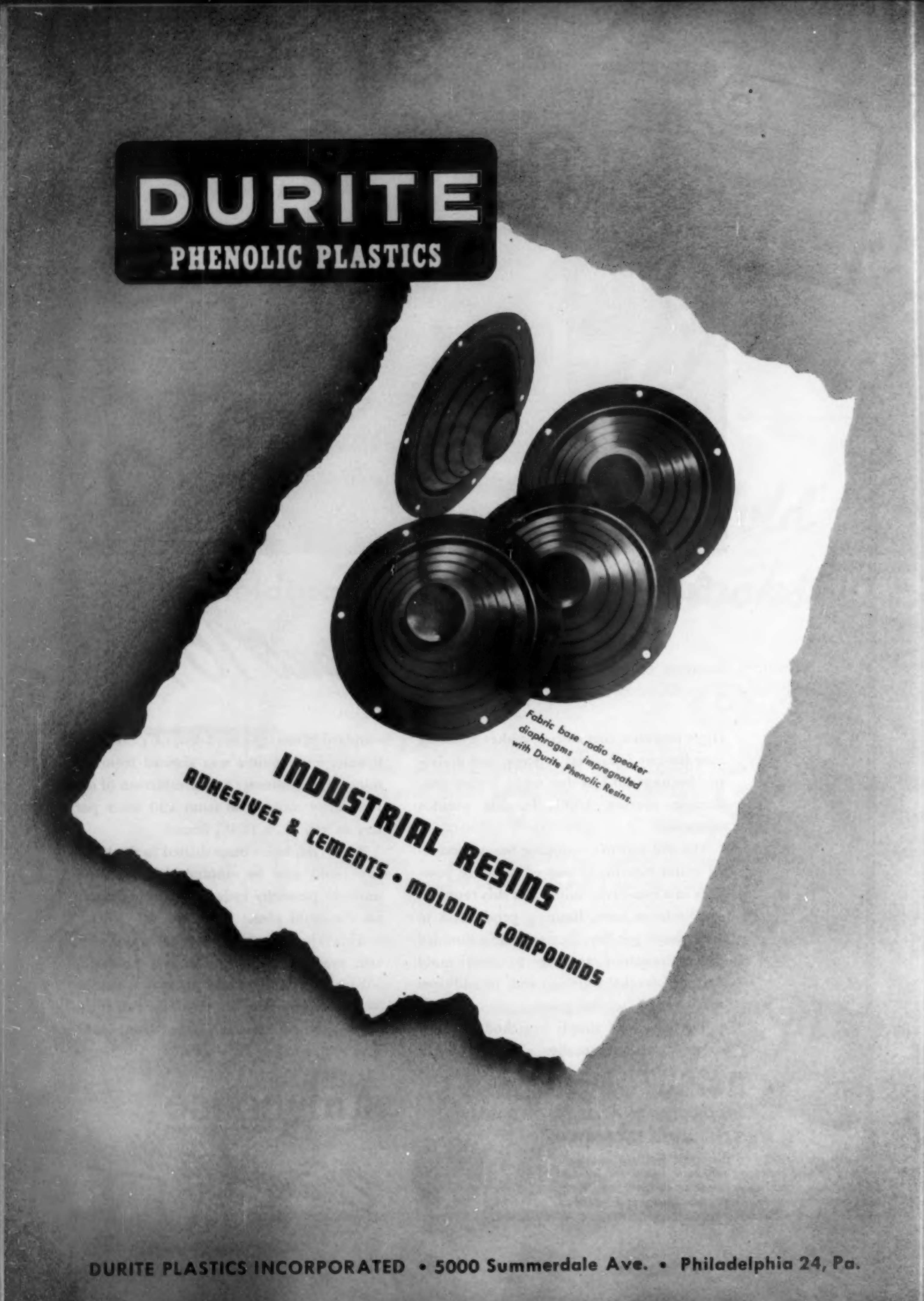

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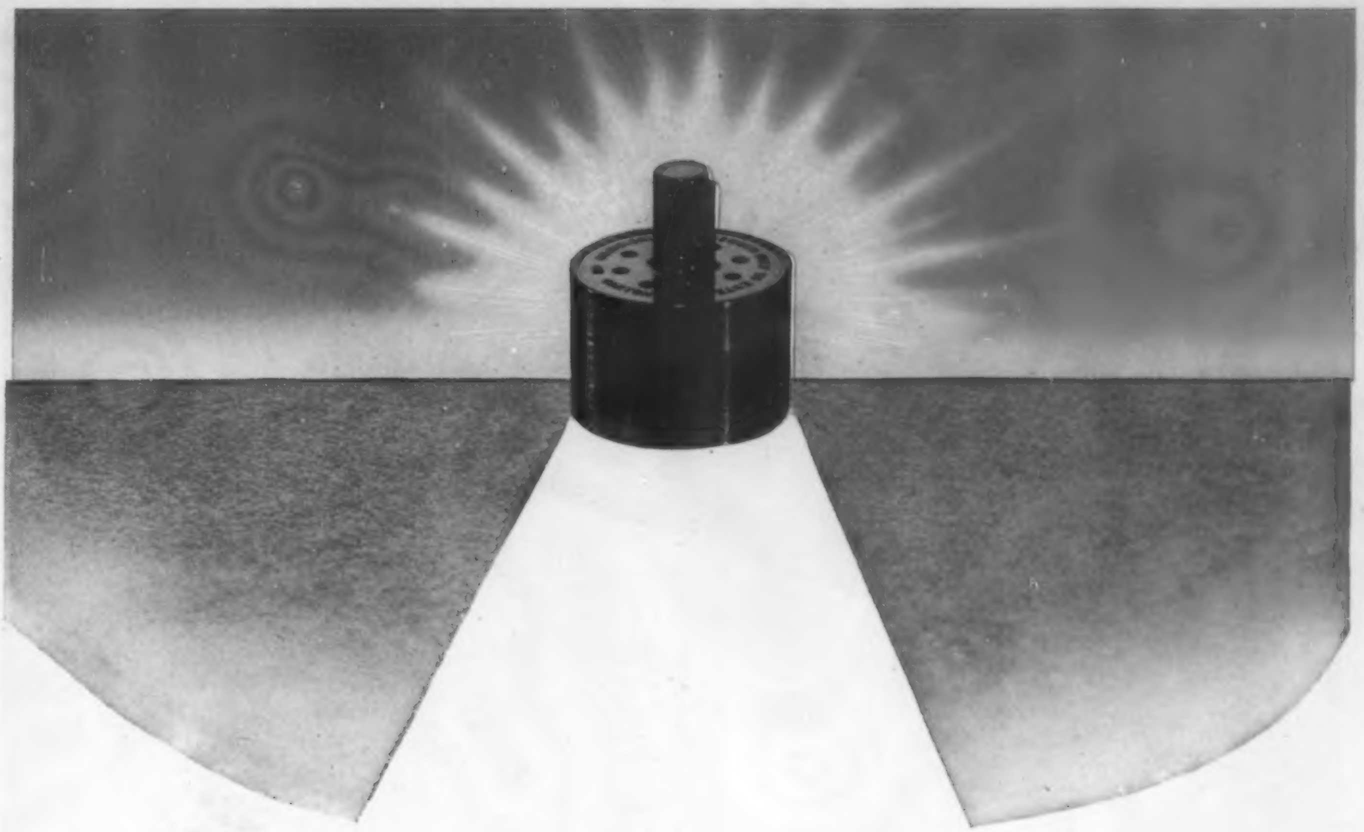

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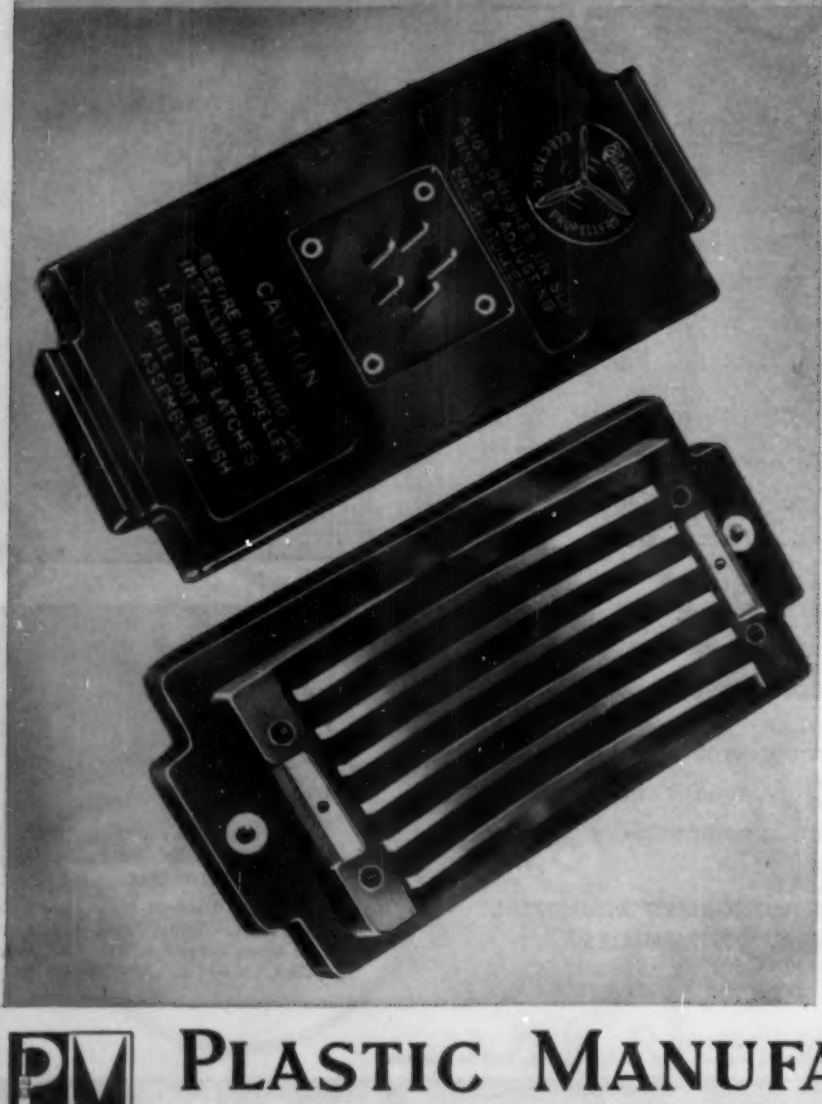

PLASTICS ENGINEERING had an important responsibility in the production of this molded brush block. Designed for propeller pitch control, the part is subject to direct motor vibration. The number and shapes of the metal inserts added to the intricacies of molding. In successful production, the plastic material affords required strength and electrical properties. Inserts are molded in, in permanent alignment. Field service problems are eliminated. ● You benefit from PMI plastics laboratory research and engineering experience when you take up your product problem with Plastic Manufacturers. For information on our plastics services and facilities, write for new Catalog Folder MP 8 — in handy form for reference.

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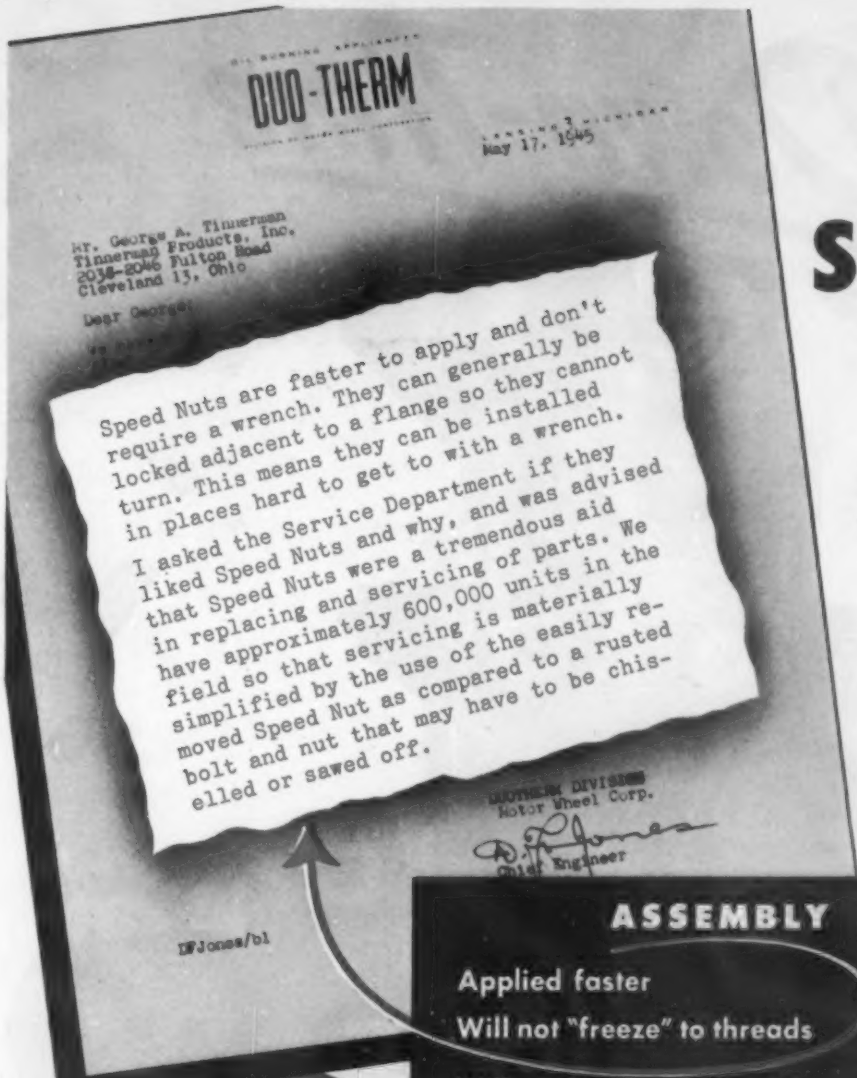

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May 17, 1945

Mr. George A. Tinnerman
Tinnerman Products, Inc.
2038-2046 Fulton Road
Cleveland 13, Ohio

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DUO-THERM DIVISION
Motor Wheel Corp.

D. F. Jones
Chief Engineer

DFJones/bl

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No. 2 in a series, "The Customer Talks"

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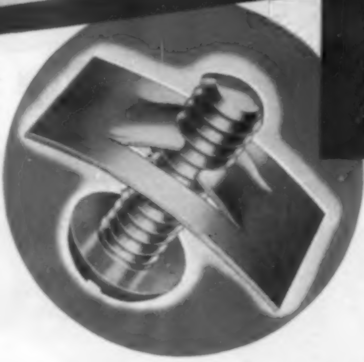

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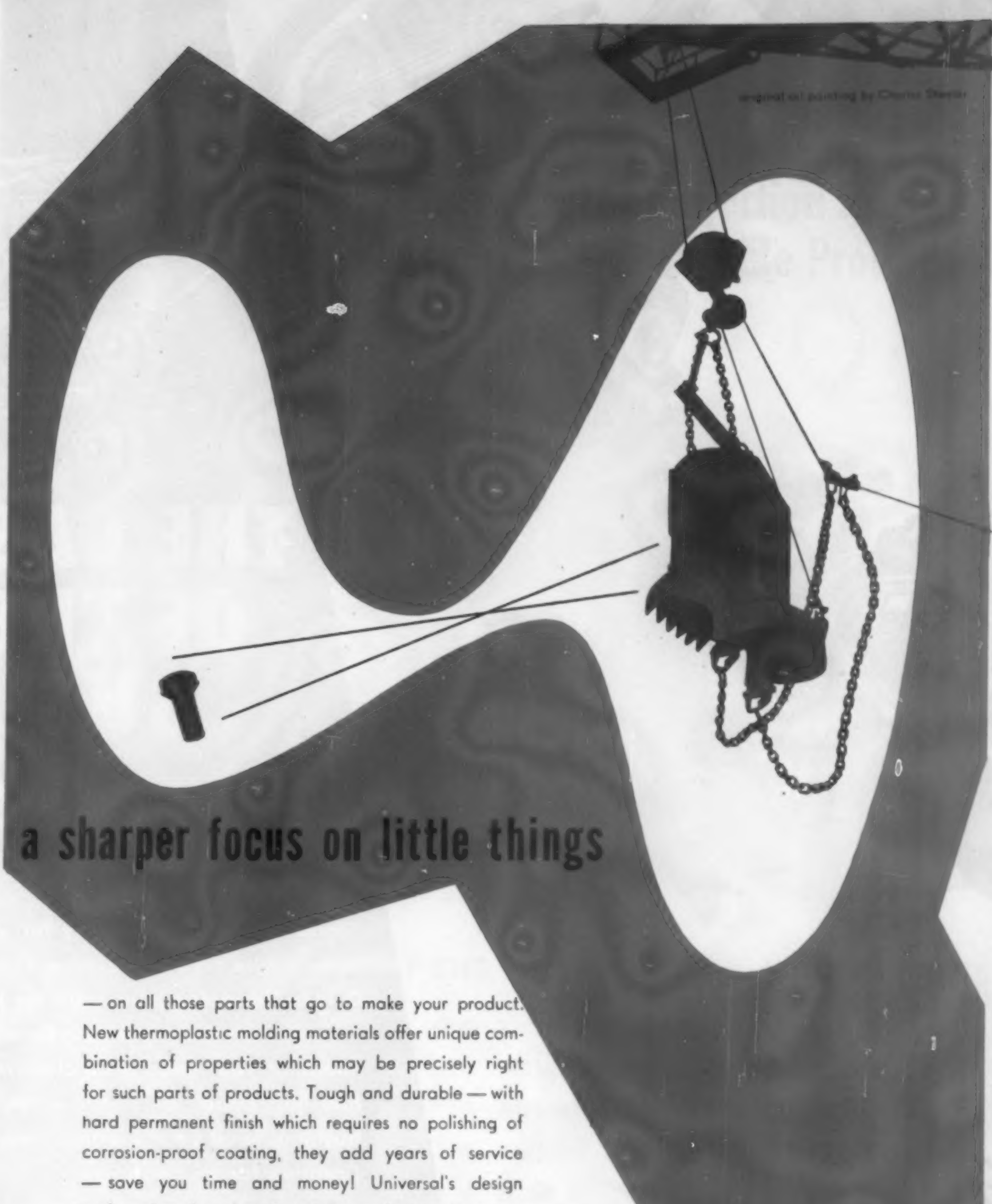

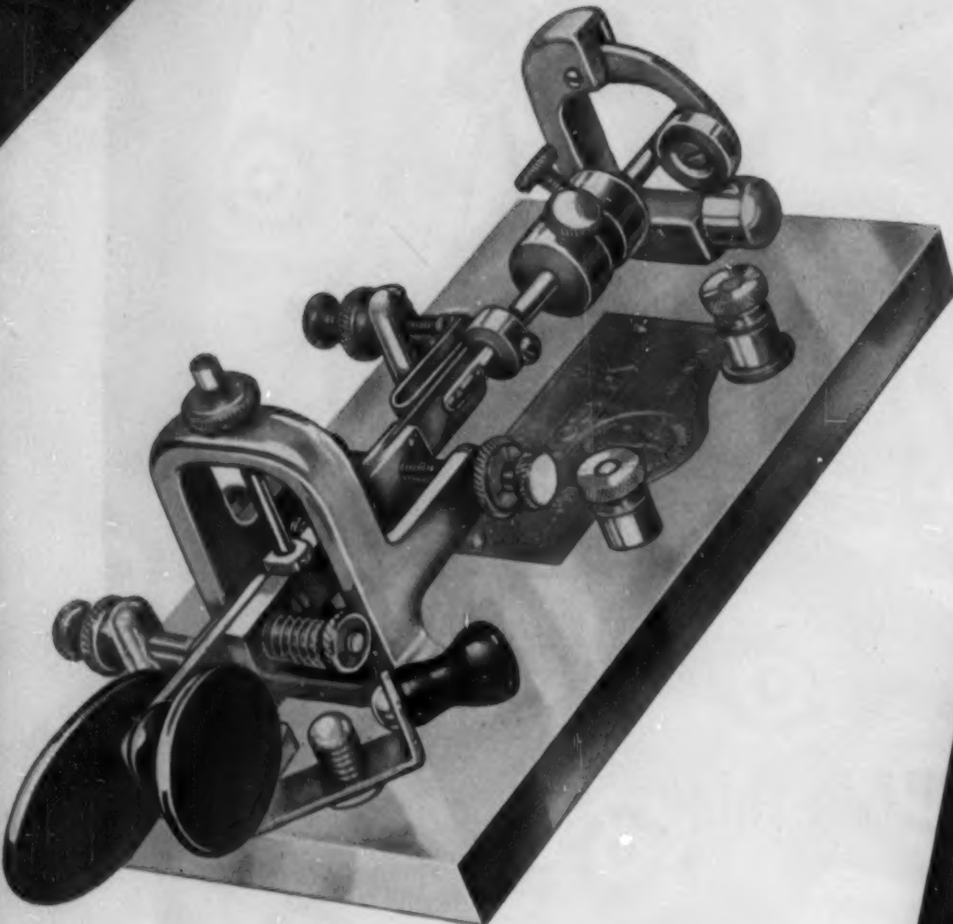

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MODERN PLASTICS

VOLUME 23 AUGUST 1946 NUMBER 12

A new material for upholstery

Plastic materials for furniture and automobile coverings gives a combination of desirable qualities. Part II of of this article will appear in September

IN November 1943, the MODERN PLASTICS' News Bulletin printed an editorial entitled "Keep your eye on the vinyls." The article called attention to the versatility and vast possibilities envisaged for this plastic product which was then in limited production only but had already proved its utility in scores of applications under most severe wartime service.

Today vinyl resin production is greater than that of any other group of plastic resins except the phenolics, latest production figures issued by the Bureau of the Census indicating a 12,000,000 lb. total for March 1946. Today all resin producers assert that they are months behind on orders. This situation is most amazing to the experts who predicted that vinyl production facilities had been vastly overbuilt during the war. Indeed the prospects have become so favorable that one of the two present producers has announced plans to double production, two other companies are building new plants and several additional chemical, oil and rubber companies are planning to enter the field.

Greatest poundage during the war went into wire and cable covering but large quantities were diverted to free film and coated fabric for protecting men and equipment against the elements. It is believed that in peacetime the greatest markets will include, in addition to insulation, such products as floor coverings, upholstery, shoes, phonograph records and lightweight film for shower curtains, aprons, etc.

This article is devoted exclusively to the use of vinyls in upholstery. These are the higher chloride content,

Unique space effects are achieved here by a combination of "walls that aren't walls" and padded wall sections covered with a vinyl coated fabric which is obtainable in almost every color and surface design

PHOTO, COURTESY PANTASOTE CO., INC.

PHOTO, COURTESY U. S. RUBBER CO.

Vinyl coated fabric upholstery was used on the backs as well as the seats of the single chairs and booths in this food shop in San Francisco

heavier molecular weight resins such as Goodrich Chemical Company's Geons or polyvinyl chloride and the Bakelite Corporation's vinyl chloride-acetate resins which are, generally speaking, a combination of approximately 90 percent vinyl chloride and 10 percent polyvinyl acetate, known to the trade as VYNW. Another is polyvinyl butyral as produced by the Monsanto Chemical Company and E. I. du Pont de Nemours & Co., Inc., which will be discussed in Part II of this article. Still another is vinylidene chloride, or Saran, manufactured by the Dow Chemical Company. The last named, with quite different characteristics but widely used for upholstery, is not considered in this article but will be taken up in a later issue.

Plastic upholstery but by another name

Plastic upholstery is not new, although it has previously been called artificial leather, leathercloth, leatherette, art leather and other names that connotate simulation of leather. It was generally associated only with textiles. Known as pyroxylin, the material consists of a fabric base coated with nitrocellulose that is plasticized with castor oil. It has been in existence for 30 years or more, steadily gaining in quantity production. According to Bureau of Census statistics the amount of pyroxylin spread in April 1946 was 6,800,000 lb., and 8,600,000 linear yards of pyroxylin-coated fabric with a total value of $3,600,000 was shipped in that month. The average monthly shipment in 1941 was approximately 9,000,000 yards.

Pyroxylin upholstery is used largely for flat slip seats on stools, dinette chairs, hassocks, office chairs, metal furniture, theatre seats and outdoor furniture. In the automotive industry it is used for kick pads and trim, including seat upholstery.

Rubber-coated fabrics have also been extensively used in upholstery for institutional furniture and particularly in the automotive field where they are popular for truck cabs and other uses where heavy duty service is encountered.

The advent of vinyl resin in large quantities coupled with expert knowledge of its processing, which was acquired by manufacturers due to war requirements, has added a new and potent material to the upholstery field. Customers have succumbed to its appeal in record time. The word plastic used in connection with upholstery is a guaranteed attention getter at furniture shows and distributing centers. The story is told that one of the early exhibitors labeled his chairs as *artificial leather* without attracting attention while another with the same type material a few booths away called it *plastic upholstery* and was swamped with visitors.

Vinyl upholstery may be either a coated fabric or unsupported film. The thickness of the latter is measured by thousandths of inches—one thousandth equals a mil. Now and then it is spoken of by gage rather than mil. General thickness for such things as flat-bottomed chairs is 10 to 12 mil; for cushioned seats, from 20 to 24 mil. One mil in thickness is equivalent to approximately one ounce per square yard in weight. Width of the unsupported film is generally 36 in. but widths of 50 in. are common in the coated-fabric field.

The fabric backing and coating compound

Fabrics most commonly used for backing are 1.12 and 1.30 sateen (weighing that many pounds per lineal yard); and broken twills which, when coated, weighs from 20 to 30 oz. per lineal yard of 50-in. material. Other fabrics used for the lighter-weight coated goods that are generally employed for flat work are 1.85 drills which weigh from 12 to 18 oz. when coated, and 2.25 sheeting with a finished weight of 10 to 15 ounces. The sateens have high tensile and tearing strength, have a diagonal weave and can be napped to give a soft feel. Twills weigh about the same as sateen but have a different construction. Drills and sheeting are lighter in

weight and have a square weave. The choice of fabrics depends on the end use and the customer's desire.

Four new Fiberglas cloths, designed specifically for use as a base for coated fabrics when high solids vinyl resin compounds are applied by the knife method, have also been recently announced.

The coating compound consists principally of resin, plasticizer, pigment, filler and stabilizer. To 100 parts of resin is added from 40 to 70 parts plasticizer and from 10 to 60 parts of the other materials listed above. Just what materials are used depends upon the choice and experience of the compounder who knows that unwise loading reduces the resistance of the finished products to flexing. He knows too that some of these materials may act as a catalyst which serves to decrease the useful life of the product.

In part at least, the particle size of the filler determines the extent of degradation. Tests of one material manufacturer have shown that the finest particles of carbon black cause the least amount of degrading while York whiting, with the coarsest particles, provides the highest loss. Another use for whiting as a filler is as an absorbent for the chlorine in the resin and as a means of helping to maintain the chlorine in the coating compound as a salt.

The stabilizer, usually an organic metal salt, is highly important. It holds the vinyl in place and gives it life and stability.

Pigments and plasticizers for upholstery

Efficiency of vinyl products depends upon quality of compounding materials and skill in blending

IN part at least, color accounts for the sharp sales appeal of the vinyls, as it does with other plastics. This is particularly evident when the vinyls are in competition with rubber which is not so receptive to pigments as the thermoplastics, which have a relatively high refractive index and are therefore brilliant in gloss.

But experienced chemists who have worked with other materials assert that pigments have to be studied all over again when used with vinyls. In the early days of development some pigments were known to leave the vinyl coating and stain garments or other materials on contact. Pigments must be selected cautiously for they may act as a catalyst, although they function as a stabilizer when used with pyroxylin. Soluble dyestuffs are said, in most cases, to be unsatisfactory for vinyl as moisture might cause coloring to come out.

Inorganic pigments are generally safe to use because they are inert to vinyl as they are to pyroxylin. But some of the organic pigments, while generally inert to vinyl have been known to migrate occasionally. It is extremely dangerous to accept advice on pigments except from the most reliable authorities and experienced users who have studied structural formations of the materials concerned. Manufacturers recognize this difficulty and generally make recommendations concerning pigments for various types of compounds.

Plasticizers

The essence or secret of vinyl compounding depends to a large extent upon the correct use of plasticizers. It is plasticizer that helps to give vinyl that soft *hand*. But too much of it will make a cushion seem draggy or difficult to slide upon.

At the last meeting of Society of the Plastics Industry, C. W. Dorn, J. C. Penney Co., spoke of plasticizers working out of shoe soles possibly by contact with other materials. He mentioned brittle baby pants that had been improperly plasticized, shower curtains made stiff by soap and water, belts from which the plasticizer came out and stained clothing. The same thing could happen to upholstery.

Plasticizers are contrary and perverse. When one is added to give a certain characteristic to the compound, it sometimes takes away another desired quality. Thus, if too much is added for tear strength, the finished product may lose some of its flex life. Another plasticizer might add drapability but migrate under certain conditions or give forth an unpleasant odor.

Vinyl is more sensitive to temperature than rubber, and the plasticizer affects stiffness as temperatures vary. Increased amounts of plasticizer improve flexibility at low temperature, but results in some sacrifice of tensile strength and pliability at room temperature or above. A plasticizer can be added that will prevent cold cracking and help to minimize stiffness at below zero temperature, but up to date it has been difficult to blend plasticizers so that the same compound will permit flexibility at low temperatures and prevent tackiness at high temperatures of around 180° F.[1]

It is well known that an excessive amount of plasticizer lowers stitch strength—an important quality of upholstery. A 30 percent plasticizer content is recommended by some authorities as the closest to ideal, but much depends upon the purpose for which the finished material is to be used. In other words, it is not yet possible to incorporate all the best qualities that plasticizers can give to a vinyl compound without sometimes bringing in either some degrading or some less desirable qualities. (*Please turn to next page*)

[1] Interior automobile temperatures seldom exceed 140° F. on the hottest days. Most applications for upholstery have a narrow range of temperature.

The merit of various plasticizers

It has been established that a plasticizer such as trioctyl phosphate will prevent cold cracking and maintain reasonable flexibility at -40° F. in 20 or 24 mil upholstery or at even lower temperatures when it is employed in 10-mil material. It is known that tricresyl phosphate will prevent film from burning. Developers of Paraplex declare it will minimize lacquer lifting; it is generally stated in the trade that dioctyl phthalate has most acceptable all-purpose characteristics including flame resistance and low temperature flexibility.

Space forbids discussion of all the various plasticizers and their respective claims to merit, but it is a wise chemist indeed who knows the *which, when,* and *why* of plasticizers so that he can obtain, for example, the finest hand possible and still maintain a balance between all the other necessary characteristics to give the maximum service life.

According to a Bakelite Corporation pamphlet, abrasion resistance improves according to the increasing amount of plasticizers used. In their test on a Kelly-Springfield tester it was found that a 20 percent plasticizer concentration registered an abrasion volume loss of 106 at 25° C. while a 50 percent concentration registered only 50. The measuring figure of 100 is the A.S.T.M. Rubber Comparison Standard (D 396–40). The different types of plasticizers used in the tests also showed varying abrasion losses of from 53 to 70. The report concludes that the amount of plasticizers to be used is based on the amount required to achieve the desired properties rather than on any preconceived stipulation regarding the composition.

Plasticizers must have a low rate of volatile loss, but a loss of 1 percent in 10 days, which seldom occurs, does not necessarily mean that, on continued exposure, this rate of loss would be maintained. In some cases a small fraction is lost rapidly, after which the rate of loss diminishes.

Three types of plasticizers

There are three types of plasticizers most often used. The newest, and one which processors have great hopes may solve many of their problems, is the solid type such as the acrylonitrile or Buna N grade like Hycar and similar synthetic rubber compounds. Its boosters claim that once this material is thoroughly incorporated in a vinyl compound there is little likelihood of its leaving or migrating.

Most commonly used at present are the chemical plasticizers which have a solvent action on vinyl resins. If the wrong plasticizer is used it would evaporate or come to the surface where it would be wiped off, as on the cushion of a truck seat, and the film would become brittle.

Another group of plasticizers is the oil-type derivatives of castor and other vegetable oils. They do *not* dissolve the vinyls, and in high temperatures the oil exudes. When used, they are placed in combination with solvent types and have one particular advantage in that they help give a low cold-crack resistance.

PHOTO, COURTESY B. F. GOODRICH CHEMICAL CO.

Polyvinyl coated fabric of all types is particularly applicable to boats for upholstery, cushions, sail covers, etc., because of material's resistance to salt spray, oil and flames

PHOTO, COURTESY PANTASOTE CO., INC.

Postwar automobiles use vinyl upholstery for trim, kick pads, etc., because it is easily sponged off and resists cigarette burns and chemicals including gasoline and alcohol

PHOTO, COURTESY T. BAUMRITTER CO., INC., AND DAYSTROM CORP.

Unsupported film in brilliant color is ideal upholstery for the new-type metal frame dinette chairs which are lightweight and built to withstand plenty of hard knocks

Finishing technique for upholstery

WHILE vinyl upholstery can be processed on either spread or calender equipment, the calender is less costly. Rubber-coating equipment has been widely used but, due to the higher temperature needed for proper calendering, best results have been obtained from calenders built especially for plastics.

It is believed that rubber coating was first practiced in the U. S. by the Hodgman Rubber Company in 1829 when they dissolved para rubber in benzene and brushed it on fabric. Today's process, involving bulky and complicated machinery housed in plants covering scores of acres in all parts of the country, is a far cry from that original manual operation.

There are few industries where trade secrets are guarded more carefully and know-how is more prized. All the older companies brag that they have the best chemists in their field and that their knowledge and experience give them advantages over competitors. Workmen and technicians are looked upon as artists. They tend to look down their noses at newcomers and maintain that it is impossible to turn out a satisfactory product without experience, especially the skill acquired during wartime when the coated fabric industry improved its technique at a rate that would take many years to equal in peacetime. The ability to specify proper compounds and the skill exercised in finishing the material on specially designed equipment is probably the most important asset any coated fabricator can possess.

The new calenders

The big new calenders designed specially for plastics are the pride and joy of the few processors who own them. They cost from $150,000 to $200,000. A complete calender line of the most modern type costs approximately $500,000. High-pressure steam is used for heating the four calender rolls, each of which is heated at different temperatures with a differential of between 230° and 350°, or even more, according to some of the operators. The rolls are carried in water-cooled journal boxes which are lubricated by means of a circulating system of forced lubrication, which means that oil is pumped to the bearings in accordance to their need as determined by an automatic thermostat system.

The entire mechanical operation is as precision controlled as possible. Experience has shown a variation of from 5 to 10° F., when operating at high temperatures, will effect the quality of the product. It is also possible, by improper adjustment of calendering or operating equipment, to produce sheeting which contains an excessive amount of residual strain, thus reducing the fatigue life of the vinyl upholstery.

Preparing fabric for coating

In coating fabrics, to insure adequate adhesion of coating to the base fabric, suitable means must be provided for preheating the fabric prior to its entering the calender nip. Means for cooling the goods after it comes

PHOTO, COURTESY T. BAUMRITTER CO., INC.

Unsupported film upholstery receives severe test in this deep spring cushioned heavy furniture for living room or den. Hundreds of pieces have been delivered with no complaints recorded

off the calender must also be provided to prevent sticking at the wind-up end of the unit. It is customary to base coat the fabric with an adhesive before applying the coating compound. The base coating, which is spread coated, is a vinyl compound compatible with the coating compound. Without the base coat it would be necessary to almost melt in the coating to get adhesion.

Before the coating material is placed in the calender the basic raw materials are mixed in Banbury mills for from 5 to 15 min. until a batch temperature of between 300 and 325° F. is reached. The fluxed compound is then further mixed and kept hot until it is fed to the calender.

The biggest of these new calenders, of which there are only a few, will handle 66-in. wide fabric varying in thickness from 0.004 to 0.025 inch. It has been reported that the new calenders will turn out from 4 to 50 yd. a minute, depending upon the thickness of the coating and the job for which it is intended.

Embossing of the vinyl

After the calendering operation comes embossing and finishing to give grain and color—another highly technical operation. Authorities say that vinyl must be well softened to be properly embossed. In rubber embossing the grain is cured into the material whereas with the vinyl, embossing is practically a molding operation. The vinyl is heated, then cooled so that the character of the finish will be set into the material. The operation must be carefully watched, for if the material becomes too soft the quality is altered.

Roller embossing is a process similar to intaglio printing whereby an engraved metal roll is used. For reasons of economy this process is used only on long runs. Engraved rolls cost from $500 to $1500 each and the frames on which they are installed run from $10,000 to $15,000. A great many jobs are embossed on flat plates placed in Sheridan-type hydraulic presses, but these plates run up to only 24 in. in depth and are generally 54 in. wide. The process of pulling the fabric through the press is slow and tedious and often leaves marks where each 24-in. strip joins with the next. New automatic presses give an almost invisible hair-line joint mark.

Finishing other than embossing

Most common color effects are Spanish—two contrasting colors—or two-tone effects, which is a combination of dull and bright shades of the same color. An attempt to get away from simulated leather is noticeable in late patterns. What may come in the future is unpredictable, but it would not be surprising to see revolutionary ideas come into fruition which would emphasize that vinyl upholstery is a new material capable of adaption to different methods of styling and to uses never before attempted.

Unsupported sheeting for upholstery

Vinyl film without a fabric backing is receiving wide attention as a new material with intriguing possibilities

ONE of the greatest points of interest in the industry today concerns the merits of unsupported as compared to supported film. There are champions for both, and we can only present their various opinions.

Contenders for fabric-backed or supported film maintain that if a fabric backing will give added strength and resistance to stretching and will eliminate trouble with stitching, then why not use backing? Contenders for unsupported film maintain that if properly compounded the film alone is stronger than when backed, has no chance to peel or crack, has a hand and draping qualities that cannot be equalled when it is backed with fabric, and can be satisfactorily sewed if proper precautions are taken.

One critic says that heavy-gage unsupported film will flow at high temperature. He asserts that a 52-in. roll recedes during calendering to 50 in. for a loss of about 4 percent. When used in an automobile where the inside temperature may perhaps reach 140° F. on a hot day when the car is left standing in the sun, this 50-in. material would have a tendency to flow back to its 52-in. width and become flabby. In furniture this creep would not be such a handicap because it is seldom exposed to such temperature. The fabric or textile, when used for backing, he says, may not be needed for strength but will act as a stabilizer to prevent this movement.

Another registered complaint is that unsupported film would not be satisfactory for such things as taxicab cushions where the driver, who sits nearly all day, would sink in and form a depression. The complainant maintains that the film would take a permanent set. If the material is given surface enough to withstand this kind of service by adding the necessary fillers for plasticizers, the fatigue life would go down according to some of the experts who maintain that the same weakness is avoided when fabric backing is used.

Other critics maintain that unsupported film can not be so successfully stretched around corners as in furniture upholstery without lowering its fatigue life—that, like rubber, it will not stand the steady strain of a constant pull without losing some of its wearability. Another criticism is that while initial tear strength is extremely good, once a puncture is made, the material is ruined. A fabric backing will eliminate both of these complaints, it is asserted.

Those who favor unsupported film declare that these objections can be eliminated by the upholsterer who should be cautioned, when applying the film over cushions and other parts of a furniture piece, to avoid sharp corners by curve cutting all recesses and by drawing the film firm, but not tight, as is customary with other materials.

Most criticism seems to center around sewing. Opponents declare that thread cuts or pulls out of heavy

PHOTOS, COURTESY RESPRO, INC.

Decorative qualities plus ease of cleaning and resistance to stain make vinyl upholstery highly attractive for restaurants

Unsupported film for webbing appeals to the public for colorful lawn and porch furniture. Manufacturers who used it as stop gaps while other traditional materials were scarce find that customers now demand it as first choice

gage, unsupported film and that it must be fastened in some other way. The answer from those using unsupported film is adoption of a slightly different technique. They space the stitches so there are from 6 to 8 stitches to the inch instead of the customary 12 to 14, and eliminate double stitching.

All parties interviewed were unanimous that for some purposes such as arm rests, door panels and trim in automobiles, or for furniture upholstery over comparatively flat surfaces such as office and dinette chairs, unsupported film is good material. A good percentage were skeptical about its use for deep spring or overstuffed cushions and furniture. The same skeptics hinted that when fabric for backing again becomes available in needed quantities there will be less demand for unsupported film. On the other hand many of those interviewed confessed that they wouldn't be surprised if someone should produce an unsupported film that would meet all requirements and others suggested that a new type of fabric for backing might be the answer.

But one processor at least has gone all out for unsupported film for upholstery, and his story and exhibits are most convincing. Further evidence is added by a New York distributor handling unsupported film upholstered furniture who declares that he has not had a single complaint after having sold thousands of dollars worth every month since January, including shipments to Tampa and other southern outlets (where heat is a severe tester for vinyl). The shipments included a goodly amount of deep spring and overstuffed furniture as well as the flat surface type.

The officials of this company point out, of course, that the material must be properly compounded. And they think that they have the secret formula that will do the job. Exhibits in their own plant bear out their claims. Deep spring settees and chairs in recreation rooms where men lounge and scuff around during noon hours have been undergoing hard usage since last summer and are none the worse for wear.

The company representative pointed out that the cushions were provided with vents to let the air out when an occupant sits down, and in when he rises from the chair. If the cushion was airtight it would be nonflexible. The vents were of the same type used with leather upholstery. Later models of unsupported film upholstered cushions have been fitted with a piece of muslin which covers about three quarters of the under surface and permits the air to flow in and out without the necessity of providing air vents.

Many other service tests are on exhibit in various parts of the country, all with favorable reports. When asked about certain dinette chairs in a New York restaurant that were wrinkly and baggy, officials quickly pointed out that care must be taken in applying unsupported film. They said, however, that upholsterers were rapidly learning how to use a slightly different technique when using this material and that these faults were corrected by upholsterers in later applications.

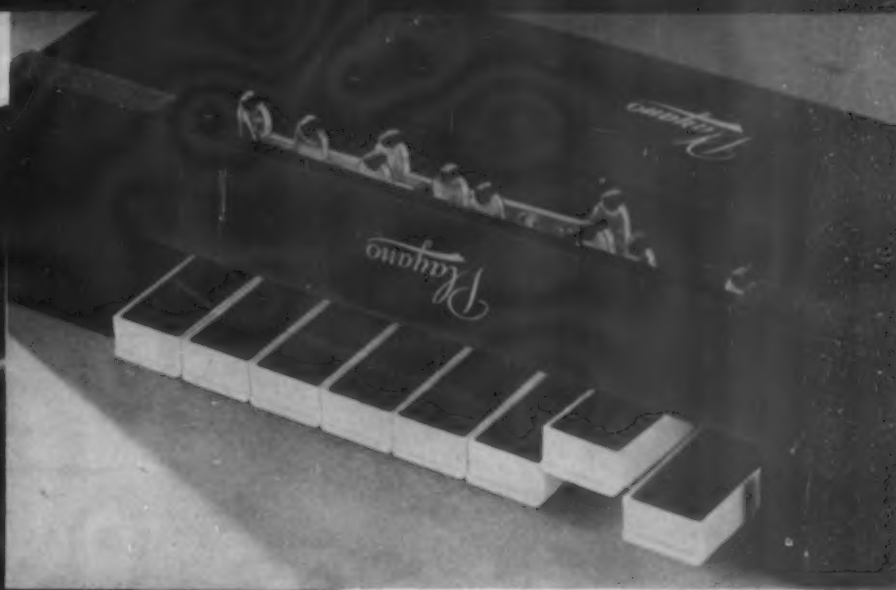
In pointing out the advantages of unsupported film this company's officials affirm that it contains more plastic and is therefore stronger than when a fabric backing is used, that it is impossible to obtain as good a sheen, feel, color or texture in a part plastic and part fabric sheeting as it is in pure plastic sheet. Furthermore, they affirm that if there is no fabric to pull away from, there is less danger of peeling or cracking.

On the subject of stitching they show any doubter a selection of club lounge chairs, Lawson-type sofas, wing- and channel-back chairs and a hassock with 20 yards of stitching to the unit. All specimens contain yards of stitching including inverted seams and welts. In addition the welt is also made of vinyl, an advantage over other types of upholstery where the welt was generally liable to show the first signs of wear by cracking.

In further testimony to the high quality of unsupported film, Mr. J. C. Shearman of Shearman Brothers Co., well known furniture manufacturers of Jamestown, New York, reports that:

Vinyl unsupported film can be used on spring construction where other types have a tendency to crease, crack or peel. He asserts that it is easier to apply generally, but that care must be used in applying buttons by using a two inch patch under the buttons or a round die cut hole to prevent tearing out. He is of the opinion that unsupported film will give longer wear because it is completely made of vinyl and has the added characteristic of elasticity not found in fabric.

Mr. Shearman is of the further opinion that vinyl unsupported film will replace other types of fabric and leather as upholstery material not only in commercial and industrial applications, but particularly in the home where it is adaptable for heavy furniture.



PHOTOS, COURTESY VAN DYKE HILL

Anyone who can whistle a simple tune and count to eight can now play the piano thanks to an ingenious attachment comprising a cast phenolic housing, eight wooden keys covered with cast phenolic shells and eight molded polystyrene strikers. (Seen above from underside of unit.)

Glorifying chopsticks with plastics

FIGURES tell us that one person in the average family plays the piano. Considering the high cost of pianos and the difficulty involved in mastering the technique of playing, that's a high percentage.

But for each person who has, through training and long years of practice, achieved some degree of proficiency, there are probably two or more who wish they could play, but for some reason—be it lack of perseverance, plain laziness or total lack of finger dexterity—have never learned. Now an ingenious invention known as the Playano, has brought this skill down to the level of the untrained, but aspiring, music lover.

This unit molded and fabricated by Maurice Lichten, Inc., is housed in a case of rich-looking Catalin and is so constructed that by using only one finger the novice can play tunes made up of harmonious chords. For purposes of appearance and economy of manufacturing operations, its inventor, Van Dyke Hill, chose to construct the piano attachment largely of plastics. Besides the cast phenolic housing, which requires few finishing and no joining operations, blends with the highly polished wood of the piano and resists warpage well, there are actually 20 plastic pieces. The most obvious of these are the eight keys, the shells of which are white Catalin with the centers filled with wood to deaden any undesirable sound.

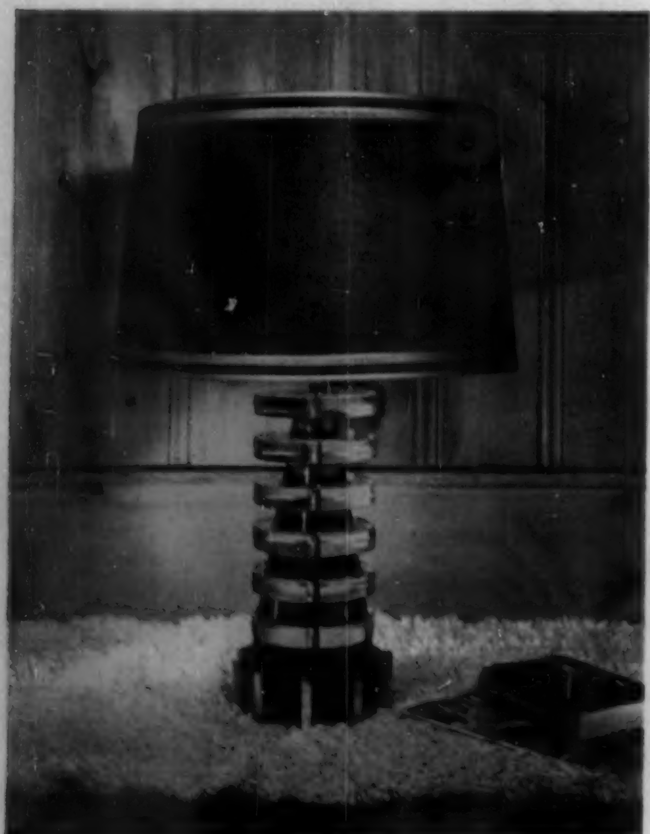
Most important, but not as apparent to the player, are the eight strikers, shown above, which are injection molded of Loalin. And here's where the clever designing comes in. Each key is attached to a striker which is made so that felt pads can be attached to the tip of each of the three prongs. These are the points that contact the piano keyboard beneath the attachment, striking three notes at once to produce a chord.

In addition to these pieces there are two braces and two strips of black cast phenolic used in the assembly. The base of the instrument is wood, again chosen for its sound-deadening qualities.

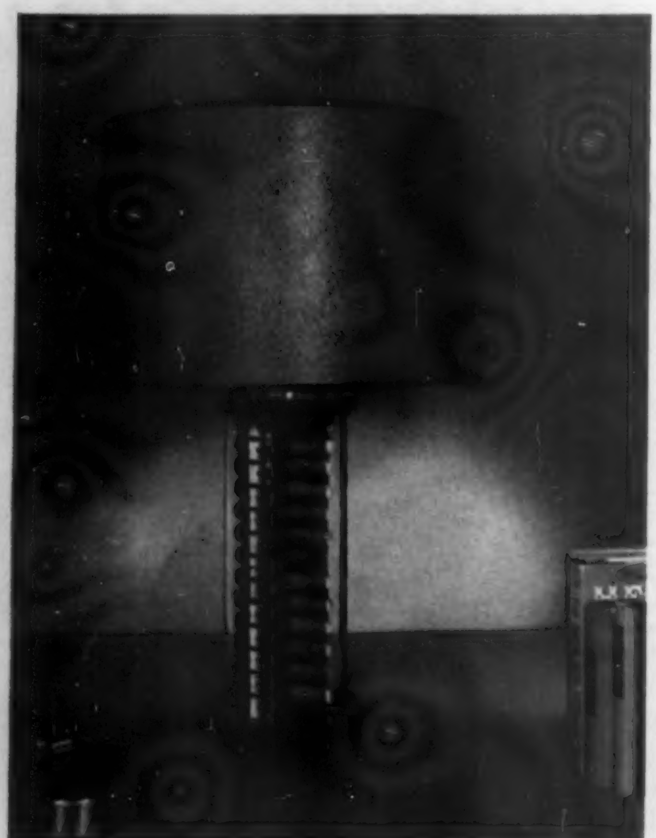
On the present model the player has a choice of eight chords on the center of the keyboard. He also may use the three-note guide to harmonizing bass notes which is placed on the lower portion of the regular keyboard. Numbers on the keys and the bass guide correspond to those in an accompanying song book. A larger unit planned for the future will have a total of 16 chords including eight minor chords, allowing a greater diversity of musical pieces that may be played.

1 — Light and dark methyl methacrylate rods alternate to make body of this lamp which has a laminated wood base

2 — Laminated tubing made from phenolic impregnated rolled linen is used with clear acrylic rods in this lamp



3 — There is no stinting of material in these lamps. Here, for example, solid acrylic disks are used, not hollow rings



4 — Clear acrylic rods cover the ends of the laminated rods which are stacked, and laid at right angles to each other

Designing lamps in plastics

Molded, fabricated, laminated plastics are used to achieve the effect desired in these lamps

Mass production, speedy production, low-cost production. Such are the outstanding advantages of plastics in the minds of a large proportion of the public. But, recently there have been appearing more and more applications where plastics have been selected as the right materials for the reason that they alone have the ability to produce the effect desired by the designer.

There can be no better example of this trend than the line of table and floor lamps now being designed, fabricated and sold by Arnold Brilhart, Ltd. The actual worth of the plastics employed in these lamps does not even enter the picture, any more than the value of the silver that is used determines the worth of a handwrought necklace. These lamps are not for the man looking for a bargain, for the man in search of lamps that are cheaper than those made of porcelain or brass. They are for the connoisseur who seeks beauty and values the correct and artistic use of a material. For such a one, mass production, speedy production, low-cost production are not the determining factors—they play, in fact, no part at all.

The why of materials

All of these lamps, some of which are pictured on the three pages of this article, were designed on the fundamental principle of using sufficient material where it should be used to give strength as well as beauty. There has been no stinting of material, no use of scrap or surplus stocks. Rather, the idea has been to design toward a desired effect and purchase plastic material for that given effect.

Thus we have acrylics used with molded phenolic, with wood laminate, with rods made from phenolic impregnated rolled linen—each material adding its own special quality. Color and brilliance, for example, are contributed by the acrylics. It is the light transmitting property of this plastic that gives the effect so desired in lamps intended for the living room and bedroom. Wood laminates and molded phenolics, on the other hand, can withstand the knocks and scratches which are the lot of materials used for lamp bases.

The varying of material not only insures beauty and faultless operation but it makes possible the keying of a lamp to a particular color scheme. Whether harmony or contrast is desired there is a plastic that fits the need. Then, too, the apparent weight or mass of a lamp can be affected by a wise selection of plastic materials. Thus a library lamp might well use a preponderance of laminated tubing in the darker wood colorings or deep-toned sections of acrylic stock. This would contrast with slender spires of clear acrylic rod or diamond-cut disks fashioned into boudoir lights.

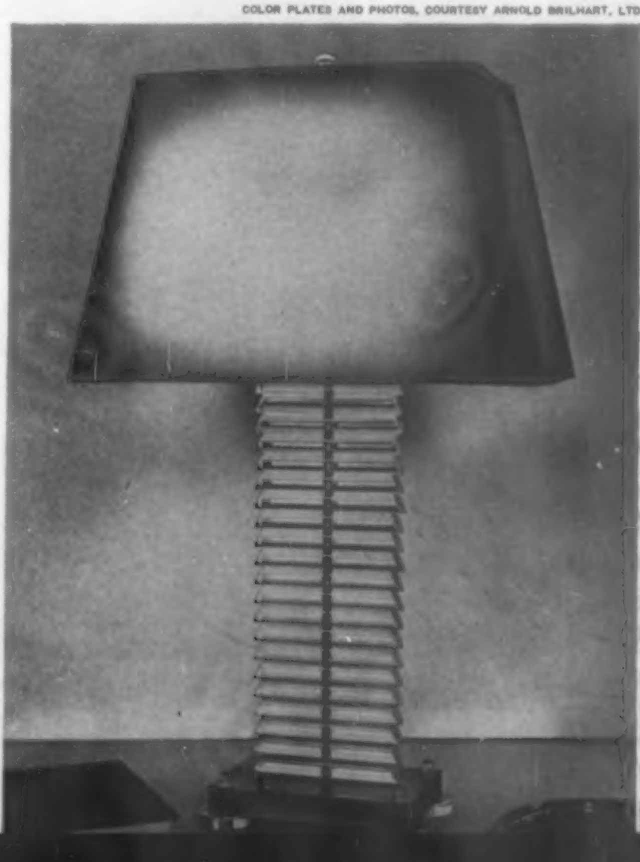
Typical designs

It takes but a glance at the accompanying illustrations, particularly the four-color pictures, to appreciate the effects that have been achieved through imaginative and generous use of plastic materials. In Fig. 1, for example, use is made of the light carrying properties of methyl methacrylate in the light- and dark-toned amber rods that make up the body of the lamp. The sweeping curve of the rod assembly serves the double purpose of insuring a balanced appearance regardless of the angle from which the lamp is viewed and of increasing the sparkle of the lamp body by presenting more and varied surfaces to the rays of the light.

This same basic design has been employed in a number of other lamps (not illustrated). In one case, the rods are made of phenolic resin impregnated rolled linen tipped at both ends with clear acrylic. As with the other lamp of this same construction, the base is of

5—The design of the acrylic bars that are piled one on another, make a pattern of the rod that extends up through the center of the lamp base. The generous use of the plastics lends an air of quality to the lamp while the light carrying qualities of the material give it brilliance

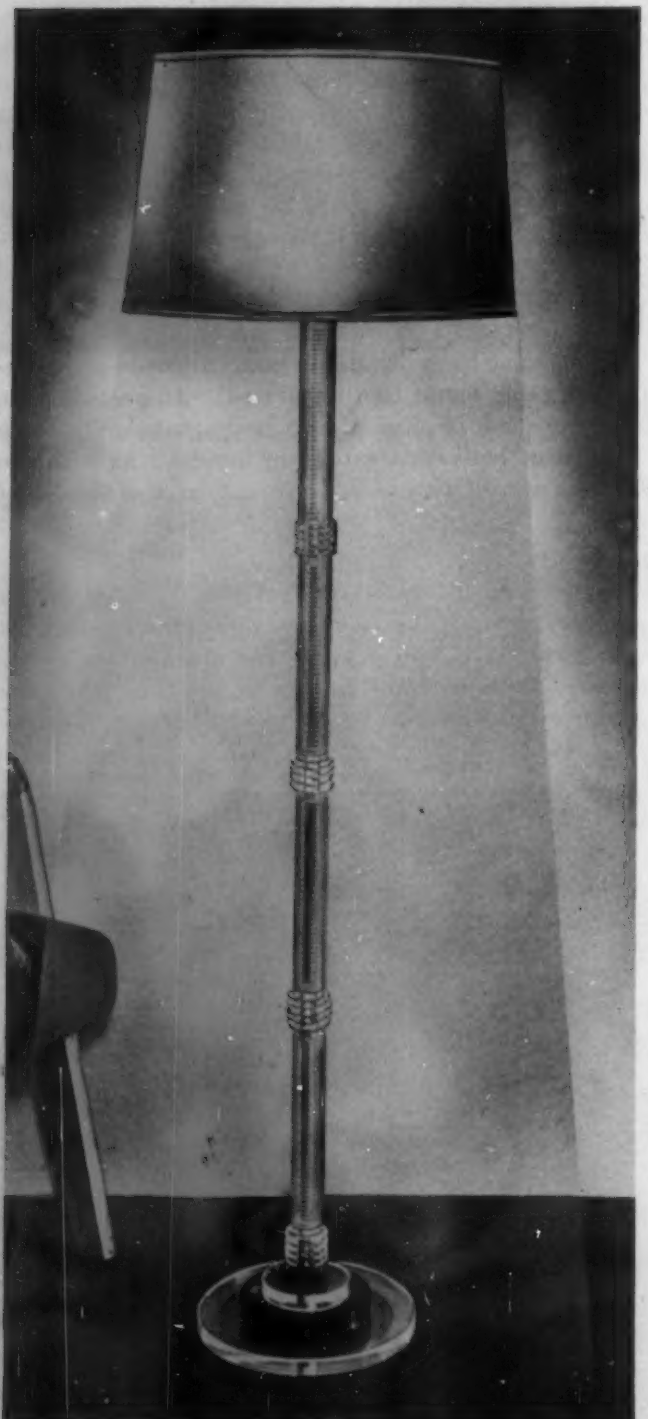
COLOR PLATES AND PHOTOS, COURTESY ARNOLD BRILHART, LTD.



laminated wood, a material which has been found to withstand the wear often meted out to lamp bases, at the same time blending with the over-all color scheme.

A modification of this stacked or tiered design is shown in Fig. 5. Rods have been replaced with flat sections of methyl methacrylate tapered at the edges so that the lamp standard brings to mind the curved roof of a pagoda. No attempt has been made to camouflage the center tube through which the wiring is strung. Rather it has been thought to enhance the design by interrupting the pattern which has been so artistically set by the clear plastic sheets.

6—Substantial but not clumsy is the description for this methyl methacrylate floor lamp standard. Again the plastic lends sparkle to the base and gives it a decorative note



Entirely different is the design shown in the second color picture on page 100. Vertical rods are the motif—in this case, alternating rods of clear acrylic and laminated tubing made from phenolic impregnated rolled linen. By substituting clear acrylic for the laminated tubes, an entirely different effect is created—more in keeping, perhaps, with the modernistic decor. Or smaller clear plastic rods may be set around a large center rod of acrylic or an opaque material.

Holding these rods in position at top and bottom are solid sections of molded phenolic. A wood laminate, however, serves as well and disks of acrylic have been used in some models.

The importance of mass

Perhaps no lamp design better illustrates the lavish use of plastics by Arnold Brilhart, Ltd., than the one shown in Fig. 3. Disdaining to sacrifice any of the desired effect to achieve a saving of material, the company uses solid disks for this lamp. Only enough plastic has been cut away to make room for the center shaft. The lamp which we have pictured is assembled from light and dark acrylic sections, but in another model only one color of disk is used. The effect is quite different when every other disk is either much larger or much smaller than those on either side. This marked contrast in size can be worked out on the pyramid principle employed for the lamp in Fig. 3 or alternate disks of plastic can be made the same size, regardless of the difference in their size. In some designs the pyramid has been upended so that the lamp base tapers downward.

Boudoir and floor lamps

Just as varied are the lamps that have been worked out for the dressing table. For the most part, however, acrylics are used exclusively to give the feeling of daintiness and charm so precious to women. A number of the designs fall back on the principle on which the lamp shown in Fig. 1 was developed. The acrylic sections are piled, one on the other. But in many cases the plastic has been fashioned into small round disks, some with convex sides, which combine to make slender light-catching shafts.

The floor lamps, one of which is shown in Fig. 6, while following much the small styling suggested for the dressing table lamp, use thicker materials. Lest the clear acrylic disks alone appear too light, heavier lengths of the plastic have been inserted down the length of the shaft of the lamp shown in Fig. 6. Weight is added to yet another model by the insertion of thin dark spacers between lengths of clear rod.

Naturally the bases for these floor lamps are much larger in diameter than those used for the other types of lamps. As in the other models different plastics materials are used—sometimes acrylic, sometimes phenolic, sometimes laminated wood.

PHENOLICS stop seepage in oil wells*

Plastic plugs which seal out gas and water, restore production and economy

by E. S. BAUER†

ONE of the most unusual developments involving a "hidden" use of plastics is the work that is being done in the west Texas oil fields where industrial resins are being used to "plug" oil wells in this way increasing both their yield and their efficiency of operation.

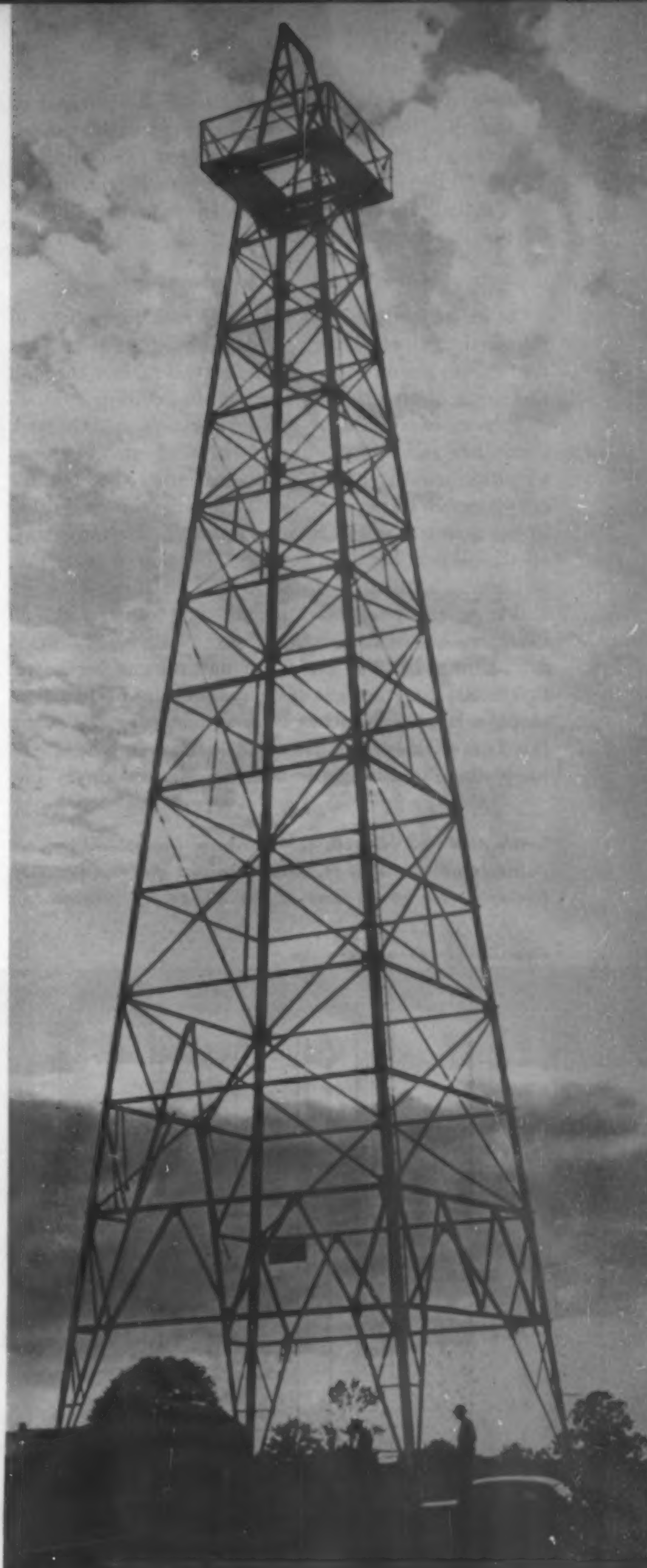
Long a problem with the oil producers has been the seepage of water and natural gases into the sedimentary rock formation which bears oil. Considerable research work and extensive testing under field conditions proved that the methods used prior to the introduction of plastics were generally unsatisfactory. Resinox proved to be effective in its sealing properties and at the same time to be economically sound.

Producing oil is a tricky problem and the problems don't cease when the drilling is finished and the oil begins to flow. The normal life of an oil well is generally considered to be about twenty-five years. Most oil companies expect that the well will bring in revenue equivalent to its initial cost within the first four years of operation. This is termed the "pay out." For the next four years, producers expect reasonably trouble-free operation. After the first eight years, however, most wells require frequent servicing or remedial work in order to insure continued flow and profitable operation.

One of the problems that involves remedial work is water and gas intrusion. As oil is drawn off from a well, the balance of the well changes. More and more natural gases and water are withdrawn along with the oil, causing the well to produce less oil per day and requiring the producers to pump the oil from the earth rather than depending on the free flow of oil induced by natural sub-soil pressures. This causes the cost per barrel to the producer (and ultimately to the consumer)

* Acknowledgment is hereby made to Fred R. Holland, Oil Well Chemical Service Co., for the field data and much of the technical data that has been incorporated into this article.

† Monsanto Chemical Co., Plastics Division.



PHOTO, COURTESY STANDARD OIL CO. (N.J.)

1—Industrial phenolic resins accomplish an important job in oil wells such as this by preventing the seepage of water and natural gases in the sedimentary rock formation, which bears the oil, and thus increasing efficiency

to rise greatly and the well must either be plugged or shut down. Before successful plugging was developed, many wells had dropped in production from approximately 50 barrels a day to as low as one barrel. Some wells actually have been shut down as non-productive for this reason.

Gas limits oil production

Oil exists in certain sedimentary rock formations in the earth under a layer of natural gas. It is the gas that causes the oil to flow to the earth's surface through the string of pipe that is inserted after drilling. However, as more oil is drawn off, the gas seeps into the rock formation and escapes along with the oil. For conservation reasons, an oil producer is allowed to remove only so much oil per day and at the same time is limited in the quantity of gas he may remove. He may draw all the oil possible up to the first mentioned restriction as long as he doesn't violate the second one. For example, a producer may be allowed to draw off 50 barrels of oil per day. At the same time he is allowed a maximum of 2000 cu. ft. of natural gas per barrel or 100,000 cu. ft. of gas per day. As the well balance changes he may find that he is withdrawing 20,000 cu. ft. of gas with every barrel of oil. Therefore he is able to produce only five barrels of oil per day. The remedy for this production limitation is to restore the oil-gas balance by means of a plastic plug. After plastic plugging the daily output of oil generally returns to the original figure.

To run such a plug, a temperature survey must first be made to determine the approximate location at which gas and oil make contact within the earth. The well is then pumped full of oil to overcome and seal off the gas pressure and after this operation the well tubing is removed.

A plastic bridge fabricated of a special material which can be drilled successfully with ordinary oil-well drilling equipment is run in on a wire line to a point slightly below the gas-oil contact. It is sealed in place with a plastic cement to prevent the resin sealer, which will be added later, from running into the bottom of the oil well.

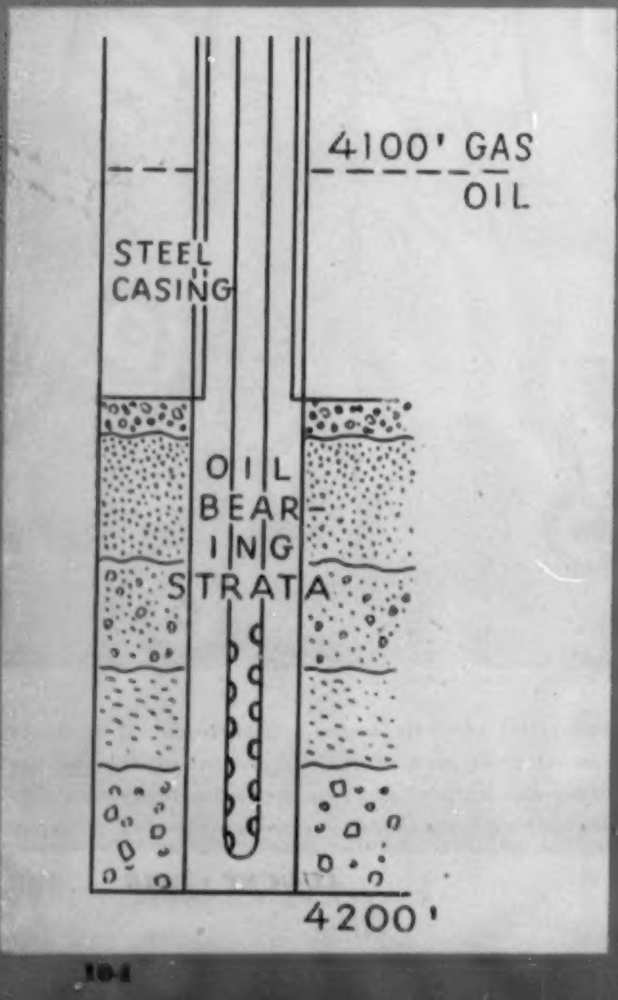
The well tubing or flow-string is then reinserted. Utilizing a specially constructed pumping truck, Resinox is then pumped through the flow-string and pressure is applied to force it out through the porous structure from which the gas is intruding. A measuring line is run in to determine the amount of fill-up and additional resin that can be added if necessary.

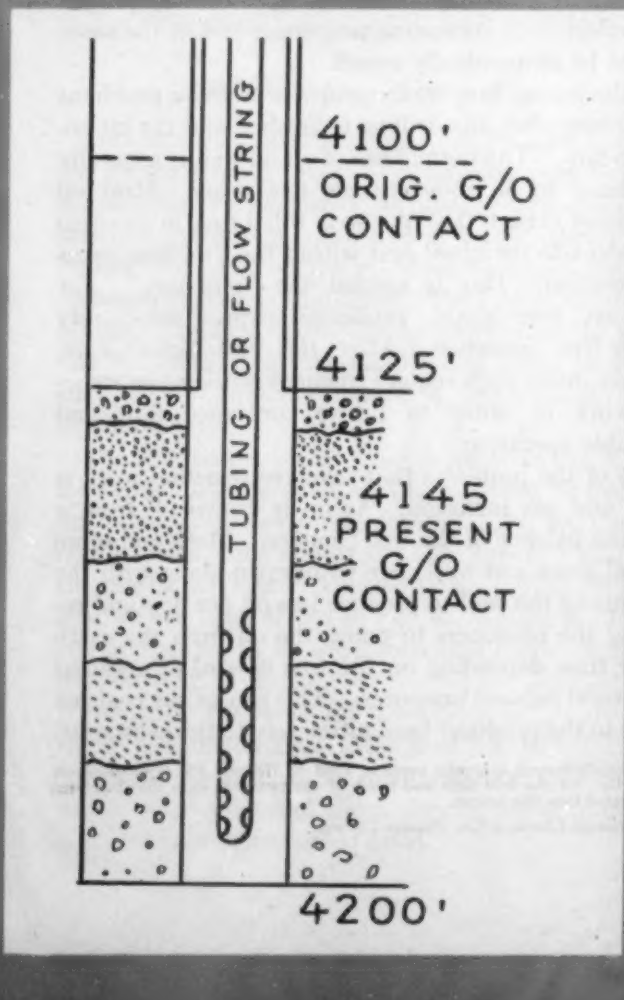
The flow-string is again removed and the phenolic resin allowed to set up. Cure time is generally from

2—On this new oil well, 4200-ft. deep, the gas-oil contact point is at the 4100 ft. level. Initial daily production is 50 barrels of oil and 37,500 cu. ft. of natural gas

3—After 6 years' pumping, gas-oil contact drops to 4145-ft. level, gas intrudes via porous rock and well yields 20,000 cu. ft. of gas to each barrel of petroleum

DRAWINGS, COURTESY MONSANTO CHEMICAL CO.





six to eight hours. A drill bit is attached to the bottom of the flow-string and after the phenolic has cured, the core of the fill-up and the plastic bridge are drilled through. The well is swabbed and is then back in production. To save time of pulling the string again, the drill bit is left in the hole.

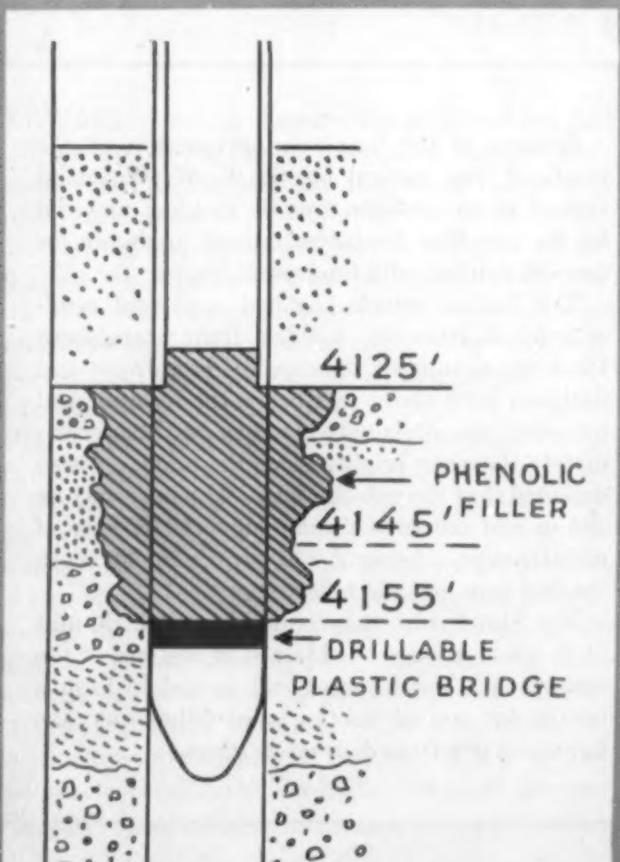
Water another major problem

Not only does the gas-oil contact level drop as oil is removed but a corresponding rise in the water table generally results. When the water table rises to a point well above the intake level, considerable water inevitably is raised with the oil.

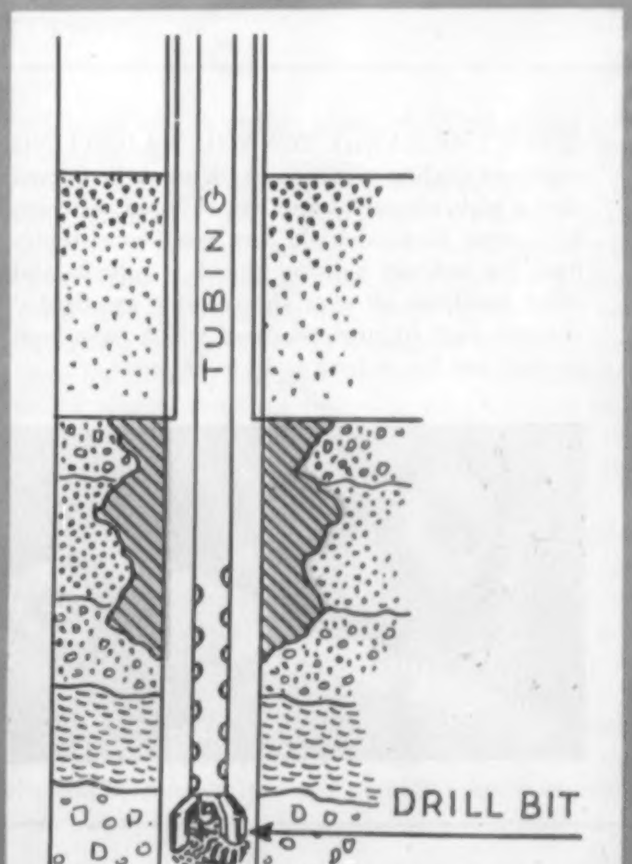
A reduction in the available gas pressure causes a well to be put on the pumps. It is equally true that a substantial rise in the water level can make it necessary to apply pumping force to raise the oil to the surface of the earth. There are five major objections to water intrusion that make it imperative that a good plug-off be done.

First, after the water table has risen sufficiently, pumps must be mounted on the well with a resultant rise in production costs. Second, it is possible that the water table will come up high enough and rapidly enough to flood the oil pay. Third, the intrusion of water into the pay carries with it a carbonaceous scale

4—In well remedial work, flow-string of this rig, through which oil flows or is pumped to the surface, is removed from the well and racked in preparation for the setting of a bottom-hole plug comprising phenolic resin



5—Flow string is removed and drillable plastic bridge is spotted at 4155-ft. level. Sirupy phenolic resin is pressured into porous rock and hardens in about 8 hours



6—Drill, attached to re-inserted flow string, reams out hole through plastic but resin keeps natural gas sealed off. Normal 50-barrel-a-day production can now be resumed

which is deposited on the face of the pay and in the equipment. If it deposits on the face of the pay, it seals off the pores and might cut off the flow entirely. In the equipment it clogs lines and is expensive to remove since pump rods and tubing must be pulled for periodic cleaning. Fourth, any water seeping into the pay may, depending on the area, carry with it a quantity of acid H_2S gas which is very corrosive to equipment. Lastly, the water must be removed from the oil in settling tanks or separators before being pumped into the carrying lines. The carriers regularly check the oil they buy to ascertain the water content and they will positively not accept more than a specified quantity with the oil.

When it has been determined that a well is delivering an unusual amount of water, the first remedial step is to locate the area of water intrusion. This is done by means of a permeability survey. Because water has a leaching effect on the rock strata, the section having the highest degree of permeability is generally the locale of water intrusion. The tubing is then removed from the well in preparation for setting a bottom-hole plug and the bottom of the well is cleaned out to remove mud or cement. Where the well contains an old cement plug, about a 10- or 12-ft. section is drilled off the top of the old plug. A sand pump is used to remove the sand and the mud.

A quantity of Resinox is delivered into the well using no more resin than would be required to fill the hole to the desired depth if none of the resin went into the rock pores. Then the resin is allowed to set for three hours. Using depth measuring equipment, the new depth is determined. The amount of additional resin needed is calculated and after the phenolic resin is added it is allowed to set and new measurements are made. This procedure is repeated until the required amount of fill has been accomplished. The well tubing is then replaced in the well, and oil withdrawn and tested. After this everything is in readiness for the resumption of full scale production.

Occasionally it is found that the water intrusion is mid-section of the string. In this case a water-plug is run in in the same manner and under the same conditions as a gas plug.

Plastic plug most successful

Cement was one of the materials initially tried for plugging wells but it shrinks considerably in a short time causing fissures which ultimately allow water to penetrate the oil-bearing strata again. Some of the gases prevalent in the oil fields are highly acid and dissolve the cement, enlarging old fissures or starting new ones. Lead filaments and turnings in the form of wool have been tamped into some wells with a steel mandrel in an attempt to seal off the unwanted intrusions. This method, while fairly effective, has a number of very serious drawbacks. First off, it is very expensive, shuts the well down for a much longer period than is required with plastics and prevents the well from being drilled deeper at a later date.

Use of plastic materials in remedial work on wells is a proved application. The phenolic plug has improved production efficiency, and aided conservation by preserving the usefulness of old wells. In addition to these effects on the volume of production, these plugs have also acted to increase the economy of operation.

SINCE THE EARLY '20S, WHEN LIGHTING engineers dealing with large work areas discovered that a high, abundant and well-diffused light was best, urea formaldehyde has been consistently used for indirect lighting shields. Schools and office buildings all over the country are lighted through such fixtures, many of which have been in daily use for as long as 10 to 15 years.

Because of the long-wearing qualities of the plastic it was natural for the F. W. Wakefield Brass Co. to consider urea as molding material for its new Star luminous indirect luminaire for over-all lighting with fluorescent lamps.

The fixture, which has end caps and semi-cylindrical reflectors molded from translucent Plaskon, eliminates spheres of brightness and darkness both above and below the fixtures, and provides the illuminated ceiling with approximately the same brightness as the unit. It is so designed that the reflector or shield panels may be slid in and out of the lamp supports for ease of maintenance. General Electric Co. molds both the end caps and the reflectors.

The Star fixture may be used as a single unit (4 ft. long) or may be obtained in sections of the same length and fastened end to end to form a continuous run of lighting used either way, the lights are free from distracting glare.

Right—The lighting fixtures are set into the ceiling in rows spaced according to height of ceiling and area of floor

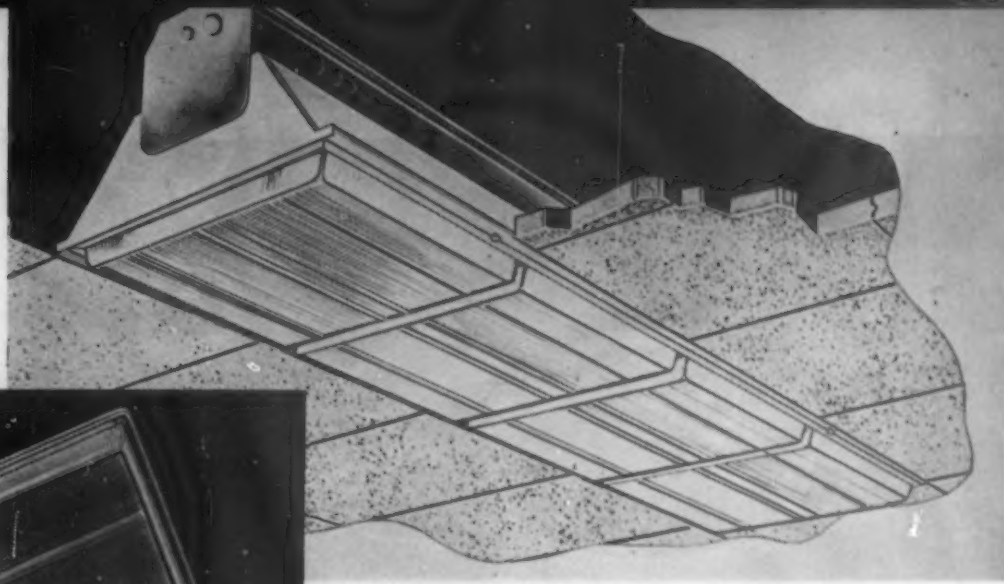


PHOTO AND DRAWING, COURTESY THE MILLER CO.

Left—Shallow dish panels for fluorescent light shields are molded of transparent polystyrene with configurated surfaces designed to conceal the higher brightness of the lamp, reducing glare through diffusion and light control. The plastic shields are lightweight and non-shattering

Pan-shaped polystyrene light shields

by C. T. MASTERSON*

A NEW idea in ceiling illumination is offered by the Miller Co. in its Troffer fluorescent lighting system, based on the principle that these fluorescent fixtures can and actually do support the ceiling. The Troffers are set up into the ceiling or have a false ceiling built around them in such a way that the light-diffusion plastic surface is only an inch below the visible ceiling, which can be made of acoustical tile or other materials supported from and between the lighting fixtures. Or it is possible to have entire ceilings composed of these Troffers. Pleasing and architecturally decorative patterns are often incorporated integrally into the ceilings with the flexible arrangement permitted by this particular type of lighting.

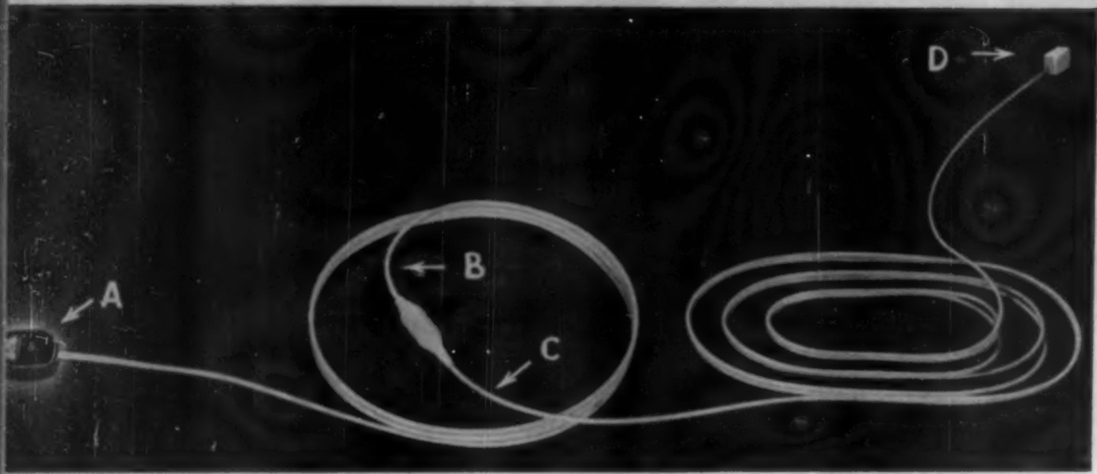
In addition, each reflector has provision for attaching a hinged door shielding assembly where it is desired to enclose the reflector with plastic or glass panels or with metal grilles. For example, there are the new polystyrene lenses or covering plates, injection molded by General Electric Company. These are made in clear plastic with configurated molded surfaces so designed as to conceal the higher brightness of the fluorescent lamp and to reduce glare by diffusing and controlling the light.

Each of the polystyrene shield assemblies is 11 in. wide, 12 in. long, 1 in. deep, weighs $^3/_4$ lb. and is assembled—in units of four—in a light metal frame 1 by 4 feet. This frame swings from the fixture on two concealed safety-type hinges and closes tightly with two self-locking sliding bolts. It is designed to permit easy access for cleaning and maintenance. While the frame can be readily removed from the reflector as a unit without the aid of tools, there is no chance of its becoming accidentally detached and endangering the heads of those beneath it.

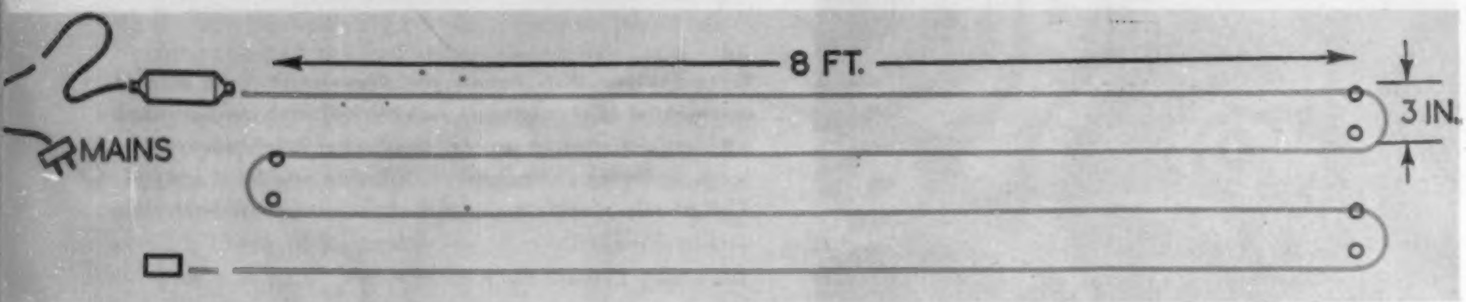
High angle light is transmitted by the vertical sides of the polystyrene dish panels, serving to increase the ceiling illumination and to minimize abrupt contrast between the ceiling and the Troffers. Over-all efficiency of these lenses is said to be approximately 62 percent.

The clear plastic lens plates provide a lightweight and non-shattering assembly which is completely unaffected by temperature and humidity under ordinary room conditions.

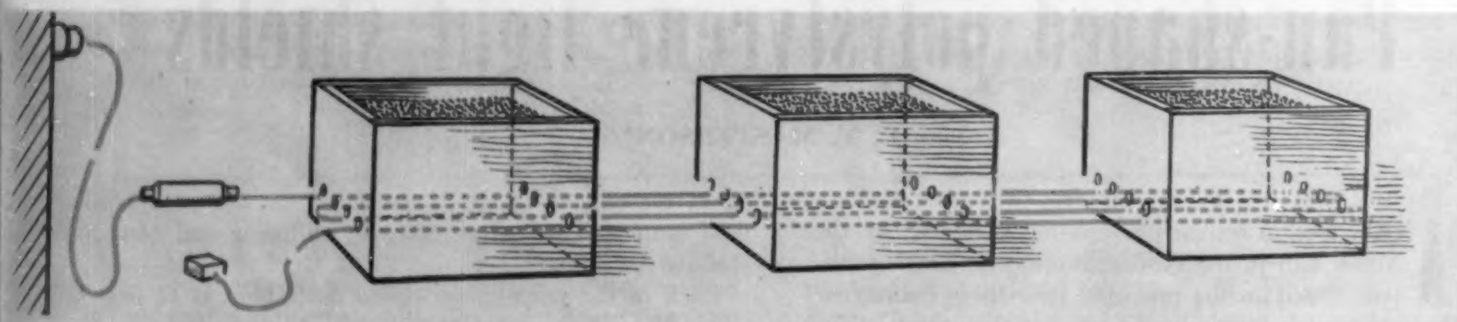
* Plastics Div., General Electric Co., and American Institute of Architects.



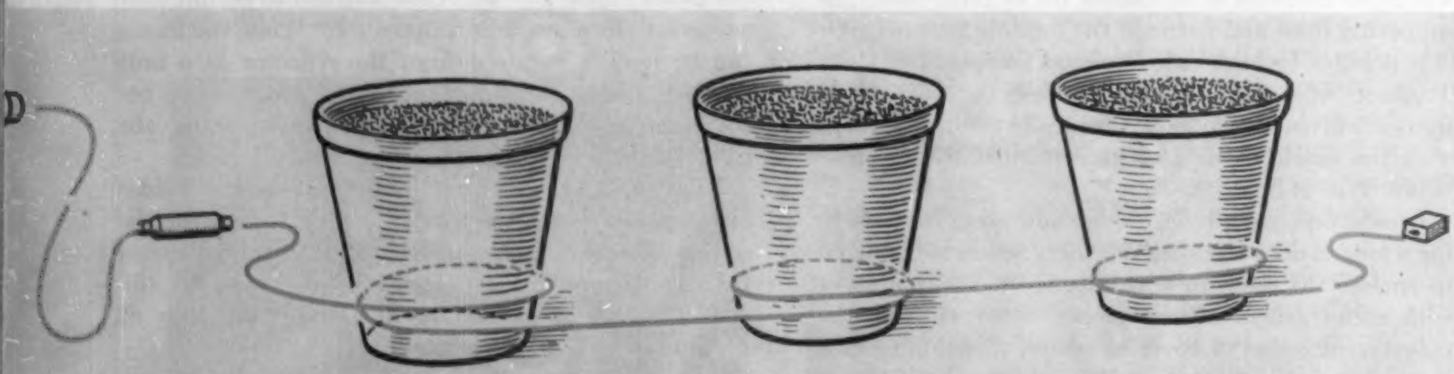
1—Flexible polyethylene tubing encases conductor and heating element of this unit for aiding seed germination. A shows the molded phenolic plug, B the conductor, C the heating unit, D the end seal



2—When only a moderate amount of heat is required for germination of the seeds, the electric heating unit, encased in polyethylene, is arranged on the floor or elevated boarding and the seed box is placed on top



3—When greater heat is needed for rapid seed germination, heating cord is threaded through holes drilled in the boxes. The cable should not be arranged so it crosses over on itself for heat thus formed will harm cable



4—When using flower pots instead of seed flats or hotbeds, heating is accomplished by winding the heating element once or twice around the base of the pots. One of these units will heat from 12 to 36 flower pots

Polyethylene tubing in the greenhouse

A new solution to the difficulties involved in the electric heating of seed boxes, hot beds and frames

POLYTHENE, which became known during the war for its insulating materials, has found an unusual outlet in the horticultural field. Acceleration of seed germination is the new use to which this material is being put by Tenaplas, Ltd., a British firm specializing in extruded plastics.

The unit in which polythene plays such a vital part is known as the Tenatherm and is said to offer a solution to a number of difficulties experienced by gardeners attempting the acceleration of seed germination by electric heating. It consists of approximately 36 ft. of polyethylene tubing, divided into two sections that are joined in permanent assembly. A twin conductor is arranged within one section of the tubing while an electric resistance heating element is housed in the other half. The two-conductor part of this appliance is fitted with a 2-in., 5-amp. phenolic plug which incorporated its own fuses.

Advantages of this heating unit

Suitable for use with either AC or DC voltages ranging from 220 to 250, the unit consumes only 100 watts. This power consumption is said to make the Tenatherm more economical to operate than hot water pipes, boiler or tubular electric heaters. Another economy feature lies in the fact that the equipment can be installed by the gardener himself. And, because of the insulating qualities of the polythene, the equipment is unaffected by continuous contact with the many chemical preparations used by horticulturists, and can be operated with complete safety even when immersed in water.

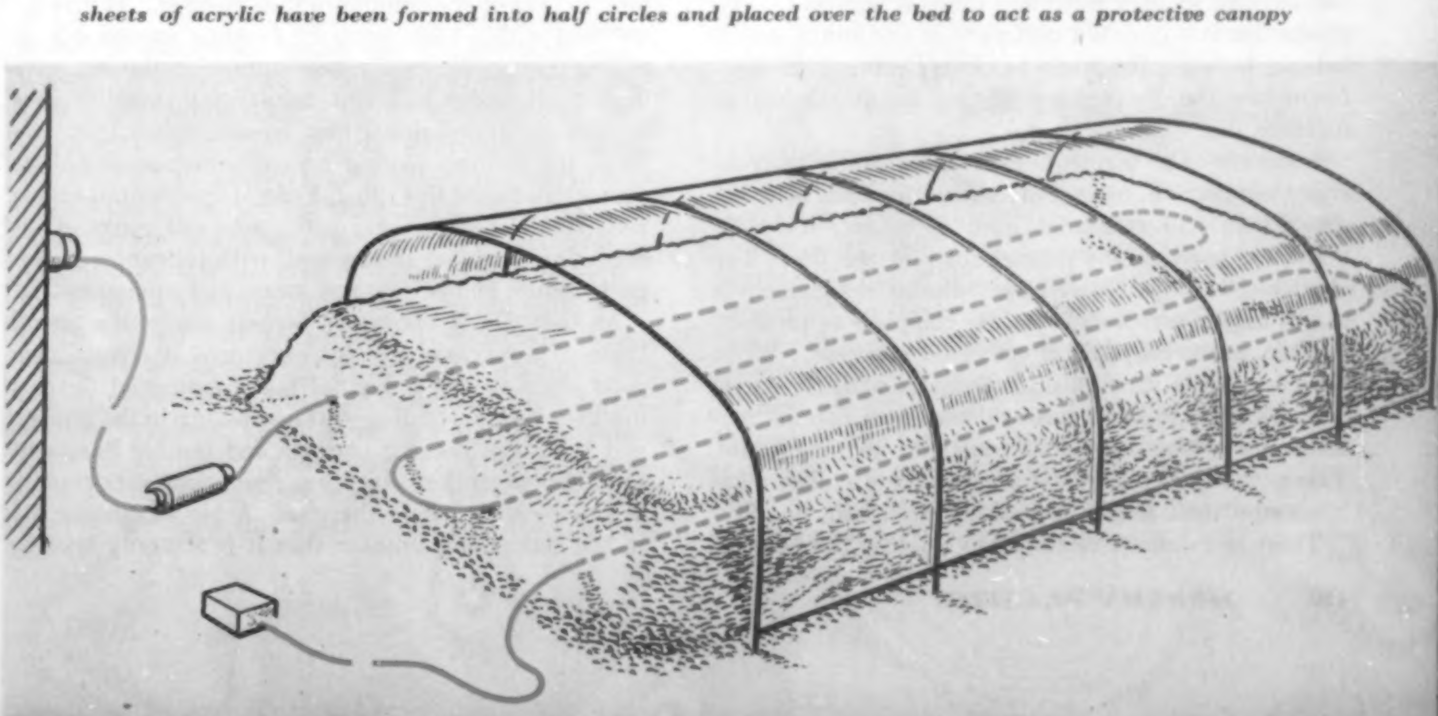
Four of the ways in which this equipment can be laid out are illustrated on this and the preceding page. The simplest arrangement is that shown in Fig. 2 where the heating unit is laid along the bench or floor and the seed boxes set on top of the cable. Where greater heating is required, as for seeds with long germinating periods, holes can be drilled in the sizes of the seed boxes through which the cable can be threaded. The box can then be filled with soil all prepared for planting. Figure 3 indicates the steps involved in this use of the polythene tubing.

When pots are employed by the nurseryman for seed germination, the tubing operates successfully when twisted around the outside at the base of the pots (Fig. 4). Depending on the size of the flower pots it is estimated that one Tenatherm can heat from 12 to 36 pots. When the pots are over 6 in. in diameter two turns of the cable instead of one are recommended.

It is also possible to use this heating unit in hot beds in the garden or as a means of removing the chill from water tanks or containers. A refinement on the usual soil hot bed is shown in Fig. 5 where acrylic sheet has been used to glaze the pile.

This description of a new use for polythene should suggest many fields in which this plastic could play an important and distinctive role.

5—The polyethylene encased heating unit can also be used for soil hotbeds as shown here. In this instance, sheets of acrylic have been formed into half circles and placed over the bed to act as a protective canopy



Thermoplastic binder for floor tiles

Plastic, not asphalt, is the base ingredient of this asphalt tiling which supplements good wearing qualities with a wide range of colors and styles

One of the many paradoxes in product naming is the fact that most modern asphalt tile contains little or no asphalt. In fact, the grease-proof asphalt tile now on the market completely belies the name, being made solely with thermoplastic resins. David E. Kennedy, Inc., for example, uses thermoplastic resins in all its tiles.

Binder, filler and pigment

As with other manufacturers, the type of resins used and some parts of the process employed by this tiling company rate as industrial secrets, but the general method of manufacturing is similar to that used throughout the industry. A tile is a "continuous phase" of binder material, holding together a "dispersed phase" of filler material and pigments. You could almost compare a floor tile to a candy bar in which the fudge is the binder and the nuts the filler and pigment.

Binder—The binder may be a synthetic resin or resins blended with a plasticizer or plasticizers. On the selection of the binder materials will depend some of the physical properties of the tile, such as its resistance to indentation, flexibility, impact strength and resistance to heat and light. On the binders that are used also depend most of the chemical properties of the tile, such as resistance to alkalis, acids and greases, moisture resistance and absence of blooming or leaching of the plasticizer.

Fillers—Fillers, which give body and wearing quality, are asbestos in fiber form and mineral aggregate. In production it is essential that particle size and quantity balance between the fillers be closely controlled. Different formulations produce different qualities in manufactured tile.

Pigments—The pigments used in the tiling are generally inorganic in nature, are chosen for light fastness, alkali and acid resistance and, of course, for their ability to produce the desired color in the tile. The alkali resistance of both binder material and pigment is most important because this company's product, Kentile, is generally laid directly over concrete. When the concrete is itself in direct contact with the earth, calcium tends to leach through, causing a flooring material not possessing alkali resistance to deteriorate. This property also helps safeguard the tile against alkaline soaps which might be used in cleaning the floor.

There is a definite relationship between the pigment in the filler and the color of the synthetic resin binder. As the result of recent developments in plastic resins, tile with the necessary and desirable chemical and physical properties can now be produced in lighter shades. Throughout the tile industry the lighter shades are more expensive, since they require more costly materials in their compounding and more expensive methods of processing for their manufacture.

Each manufacturer in the field has his own specially designed machinery, but again the principle is the same in nearly all cases. The materials are thoroughly mixed all at one time on a dispersing machine and are further blended on a 2-roll machine, coming out of this last named unit in a plastic state. The mottling, or marbleizing of the material is achieved on this 2-roll mill—the field shades and each mottle color being premixed individually, then blended on the 2-roll mill. The time the materials are in this mill determines the amount of mottling in the finished tile, the direction of the mottling (whether swirl, dot or rod), and also to some extent the smoothness of the finish.

After mixing and blending the material is calendered while hot to a thickness of either $^1/_8$ or $^1/_{16}$ of an inch. The sheets are then cut with steel dies into different sizes, and allowed to cool and harden on a flat surface.

What the tile will withstand

The plastic qualities of the tile are quite important in its application and use. The finished product possesses some cold flow properties and is inclined, therefore, to take on the contour of the sub-floor. It may be softened with a blow torch for bending around curves and in this position will retain surface continuity, having at all times sufficient base compressibility and surface elongation under heat to accomplish this. As far as the wearing qualities, grease-proofness and other characteristics of this tiling, Federal specifications have been established (involving the rate and range of indentation sizes and thicknesses) with tolerances in impact, flexure and curling resistance, and squareness.

Asphalt tile is linoleum's biggest competitor in all types of applications. Not only does it command a good share of the industrial and commercial flooring markets, but it is finding wide acceptance in the kitchen and bathroom flooring markets and the big basement or playroom market which was developing very rapidly in this country before the war. A big advantage lies in the claims of its maker that it is the only flooring

COLOR PLATE, COURTESY DAVID E. KENNEDY, INC.

Rumpus rooms of the future are likely to look like this with clear, bright colored tile floors that will resist wear, chemicals and greases. The floor "tiles" are composed of mineral aggregate or asbestos fiber fillers mixed with a resinous binder and formed by calendering process

that can be laid on concrete which contacts the earth.

The wearing qualities of this tile, which has as its base a thermoplastic resin, are already established. Colors, for example, go clear through each tile so that wear and abrasion doesn't change the shades or dissipate the mottling. Besides wearability the tile has the advantage of adaptability. An infinite number of floor designs can be worked out with this tile due to a wide range of sizes and colors in strips, squares and oblongs. And with all this the cost of installation is quite low due to the fact that an asphalt clay emulsion type adhesive is used and no pressure is required. When alterations are necessary, involving, for example, the moving of partitions, only the individual tile affected need be replaced. This eliminates the expense involved in recovering a large section of flooring as is often the case when sheet or roll flooring is used. Because of the close specification requirements and because of the length of life possessed by these tile floors, the manufacturers have developed special waxes and finishes for use on them.

New homes promise bigger markets

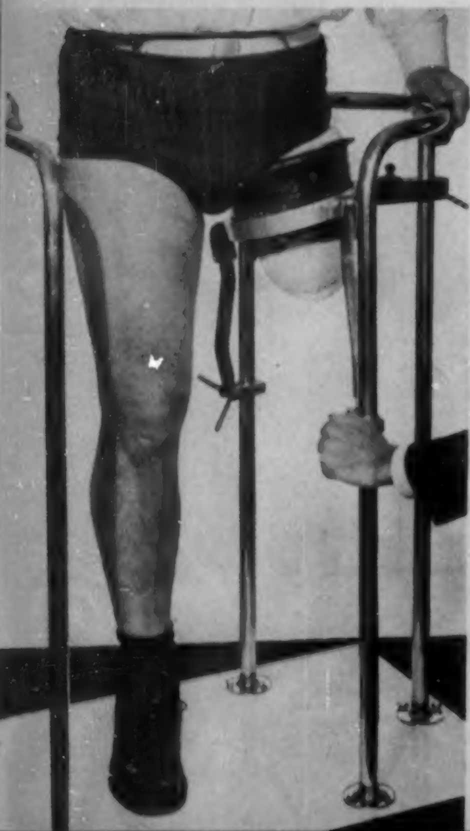
In the next few years hundreds of thousands of new homes and commercial building will be constructed in which large quantities of this thermoplastic resin tile will be used. With such new developments as radiant heating the use of this type of tiling will almost be a necessity. In this conjunction it is interesting to note that recent tests show that a floor temperature of 105° F. produced no ill effects in the tile.

These new homes will demand brighter, lighter colors; the new de luxe tiles will have them. And constant research on the part of both synthetic resin manufacturers and resilient tile makers is expected to produce ever widening markets for plastic tile.

Artificial legs must be

Light
Strong
Well fitted

by LEGRAND DALY*



The amputee stands in the fitting machine while a wax impression is made of the stump. A glass fiber fabric bucket holds softened wax

2 *An artificial knee is adjusted in proper relation to the stump impression. The rubber foot is also fastened to metal connecting rod*

3 *The assembly, consisting of belt, impression bucket, knee, foot and adjustable pylon, is fitted to amputee for alignment, comfort*

THE Paramount Rubber Company became interested in plastic artificial limbs largely because some of our own engineers came back from the war as amputees and were convinced that the legs provided by the Government could be improved upon. As a result of our men's experimentation we believe that we have made progress in developing a more satisfactory limb than the type prevalent several years ago and have found a way to fit limbs so that they can be worn with more comfort. We make no claims to superiority, but inasmuch as our own men and a few others whom they have fitted are wearing these legs with apparent satisfaction we would like to offer our experience and results as a part of the general information on this subject.

Our program for the production of artificial limbs is based on the three following points:

1. It is essential that the leg fit properly. Consequently, we attempt to fit the limb by applying exactly the same pressure to it as the amputee would apply to a normal limb.
2. The limb is never put together until the socket is molded under exact pressure as applied by the amputee himself under walking and service conditions.
3. The limb must be as light as possible, but not so fragile that it cannot withstand any kind of pressure exerted by the amputee.

Principle features of this program are: a) a molded plastic socket; b) a fitting machine which permits assembly of the limb with the use of jigs; c) Fiberglas impregnated with Plaskon 911 contact resin as the material for the leg proper. Incidentally, while we have used duck successfully, our development has been largely with glass fiber. Similarly we have

* General manager, Paramount Rubber Co.

found that the fitting machine can be used with aluminum or wood artificial limbs, although most of our work has been with plastics.

Our chief engineer on this project is former Capt. J. H. Brown whose leg was amputated above the knee after he was wounded at Anzio. He is a former football tackle, is 6 ft. 2 in. tall and weighs 220 pounds. He has worn several types of artificial limbs but says he prefers the one he has made himself in our laboratory.

Figure 1, the first step in the process, shows the impression bucket in place on the fitting machine. The bucket is made of 7 mil #128 woven glass fiber fabric and a contact resin. With the patient standing upright, X-rays can be taken of hips and back to assure proper posture. This is very important since an improper fit might cause improper walking habits.

The impression bucket is made in five sizes varying from 16 to 24 in. in circumference. The nearest size to the patient's stump is chosen, with an over-allowance of one inch in diameter to allow space for the impression compound. Before the patient places his stump in the bucket, the latter is lined with a $^1/_2$-in. layer of a mixture consisting of ordinary dental and carnauba waxes. The bucket is then immersed in hot water at a temperature of from 126 to 130° F. for from 5 to 10 min. to soften the wax. It is then put back in the fitting machine whereupon the patient, whose stump has been covered with cold cream or placed in a latex bag, adjusts his full weight to a normal standing posture just as though he were standing on two good legs. The ring around the bucket is carefully adjusted for comfort. The bucket impression will be a replica of the upper portion of his stump.

After this wax socket impression has been made, the proper height, alignment and sizes for the shin, knee and leg are obtained by measuring the patient's good limb while he is sitting down. This gives the position of the knee bolt which is incorporated later.

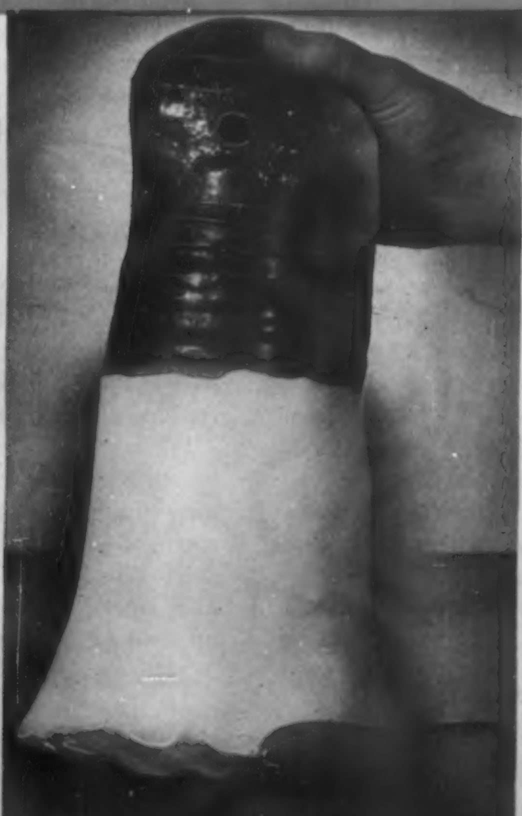
The next operation is to assemble the pylon as shown in Fig. 2. An artificial knee of Fiberglas and resin is then chosen to match the good knee. Three sizes for right or left leg are kept in stock.

The knee rod is inserted in the knee and attached to a metal rod which in turn is fastened to an artificial foot with a shoe of proper size. Care must be taken that the knee and ankle bolts are exactly parallel and that there is a toe-out of $^1/_2$ inch. Then a metal ring is fastened around the plastic knee above the knee bolt and adjustable metal sleeve pistons are fastened with screws (Fig. 2) to join up the metal ring on the stump bucket and the plastic artificial knee. Next, an adjustable belt is fastened to the machine frame so it can be fitted with the pivot point slightly forward of the hip to allow belt to rest beside hip bone.

The assembly now consists of belt, impression bucket, plastic knee and foot and adjustable pylon. The unit now has action similar to the piston and connecting rod assembly of a fine car engine.

The patient again steps into the impression bucket, adjusts the belt and the final fitting is begun under walking pressure. Correct distances and alignment between knee and foot, or knee and socket are obtained by

4 *Upper leg assembly is removed. A rubber bag, plugged at knee end, connects bucket and knee section. Plaster of paris is poured inside*



5 *After plaster sets, bag and rings are removed and mold is dried in an oven. Impression wax melts, leaving a mold of exact stump dimensions*

6 *Glass fabric, impregnated with contact resins, is wrapped around plaster mold. After heating, the plaster is chipped out of the form*

7 *An amputee fitted with the artificial leg apparatus. Entire assembly has been coated with flesh-colored paint to give it a fairly natural appearance*

adjusting the rings and universal joints on the connecting rods. If necessary the bucket impression can be changed by machining with grinder or sandpaper.

Then the upper assembly section is removed and an open ended rubber bag, plugged at the knee end, is used to connect the bucket and knee section. Plaster is poured into the complete upper leg form. When set, rings and bag are removed and the mold is dried in an oven. The impression wax melts and is scraped off, leaving the upper portion of the mold with outside dimensions corresponding to those of stump (Fig. 5).

When dry, the upper portion of the mold is wrapped with Fiberglas impregnated with Plaskon 911 contact resin from about 1-in. below the top of knee section to the very top of the mold. The form is cured in an oven under infrared lamps at 250° F. for one hour. After removal from oven the plaster is chipped out.

A metal brace about 1 in. wide and 8 in. long is attached to outside upper part of leg with a screw for which inserts were provided in bucket. After braces are in place, entire assembly is covered with Celastic for greater shock resistance and as shatter proofing.

The entire limb is then assembled—the belt, control straps which operate the knee joint from the belt, upper leg, knee, shin section and foot. The three last named parts are taken from stock. The control straps are attached to a pulley-like arrangement which fits on the knee bolt. A braking device prevents the leg from "kicking-out" too far and Oilite self-lubricating bushings are installed throughout.

The knee is fastened to the shin section by the knee bolt and a metal stop covered with rubber is attached to the shin so that when the knee bends it hits the rubber and prevents clicking. We are experimenting with an air piston control which will eliminate the knee stop and control all movement between the shin and knee.

The rubber foot is screwed to the shin section pylon and fitted with a matching size shoe. After a patient has worn one of these limbs for some time, the shoe upper will be creased or wrinkled in natural fashion. In most limbs the shoe on the artificial foot is always noticeable because it shows no wear.

The reader will note that several holes are made in the various parts of the leg for screws and bolts. To prevent the screws from pulling out through the plastic we use thin metal parts between the glass fabric wrappings in locations where rivets are to be employed.

After assembly the entire limb is roughened and carefully covered over with a very thin coating of Celastic. In addition to making the surface smooth, this covering gives better tooth for the paint which is sprayed over the surface to produce a natural finish.

When finished, the leg above the knee weighs about $7^1/_2$ pounds. It is heavy enough so that it can not be blown out from under the wearer in a wind storm, but not so heavy that it becomes uncomfortable to the wearer. The below-the-knee-unit is made and fitted in a similar manner and weighs about $3^1/_2$ pounds.

The shin and knee sections which we keep in stock are made in all the necessary sizes in our own plant. The metal molds for these parts are made from plaster casts. Cerrobase metal, with a melting point of 250° F., is poured into the mold with a ladle. It cools almost immediately and can be taken from the mold and allowed to dry, after which it is soaped to prevent the resin from sticking and wrapped with 2-in. wide strips of Fiberglas impregnated with Plaskon 911 resin. We use a 7 mil inner wrap and 3 mil on the outside to obtain a smoother finish.

After the mold is wrapped we place it in an oven for 2 hr. where it is cured at a temperature of from 180 to 200° F. After curing, the whole form is placed in a wire basket and dropped into hot oil which melts out the cerrobase metal. The molded knee or shin is then sprayed with ethyl cellulose, coated with Celastic, sprayed again with cellulose acetate, painted flesh color.

We coat or impregnate the glass fabric in a single home-made roller machine which pulls the cloth through a resin bath and cuts it into $2^1/_2$ in. widths as it comes out of bath. Raw-edged tape is desired because if ribbed on the edges the extra thickness at each edge would make ridges in the wrapping when we overlap it as it is wound around the knee or shin mold.

Before the fabric is treated we heat it to get rid of all the oil which the Fiberglas fabric had absorbed during its original manufacturing process—so that the impregnating resin can thoroughly saturate the fabric.

After impregnation, cutting and reeling, we place all finished reels of fabric in an ice box to prevent setting-up until we are ready to use it.

PLASTICS PRODUCTS

Fashion

The "seeing is believing" axiom sells shoes, for when mother knows how a shoe fits her child's foot she is more likely to buy. Step Master Shoes, Inc., supply their dealers with Vinylite transparent-vamp sample shoes so the customers can be the judges

Plastics go formal in a sparkling gown of Saran multifilament yarn, experimental development of United Merchants & Manufacturers, still not generally available

Like Bo Peep's crook, new umbrellas have tall staffs with graceful handles. This one with handle and tip fabricated of Plexiglas and Lucite by King Plastics Corp., is made by King Novelty Co., Inc.

For the hubba hubba hep cats—a colorful two-piece cellulose acetate hair ornament injection molded by Benhur Products, Inc.

Each dainty film soap flower provides soap for one washing, then disappears. Florence Barton, Inc., makes them using Hercules CMC as a film-forming ingredient. George V. Clark supplies acetate boxes

Choice of lovely ladies—a 3-piece cellulose acetate dresser set that is charmingly decorated and comes in soft shades. Pieces are lightweight, will wear well and have a smooth touch to the hand. Gemloid Corp. is the molder

HOME UTILITY

Here's a family of Koroseal kitchen aids offered by Seal Sac, Inc. Covers fit everything from platters to milk bottle tops. A zippered container holds bread, another is for vegetables. The bowl cover prevents spattering when liquids are beaten

Treading on plastic-coated rugs in rumpus rooms and porches may become routine because the vinyl butyral coatings render them resistant to water, fading and stain. This rug has paper twine base coated with Monsanto Chemical Co. resins

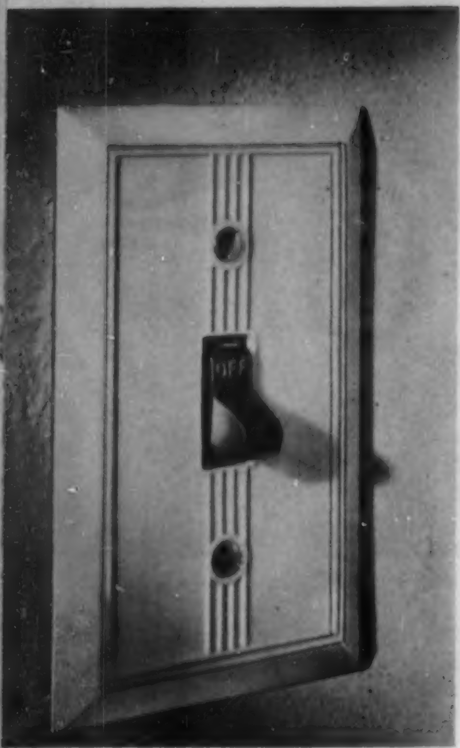
Housewife's haven on hot days is an electric iron with a cool, self-insulating handle compression molded of Durez by General Industries Co. for the manufacturer, Waverly Tool Co.

Say it with flowers—planted in earthen pots and set in colorful Tenite holders molded by T-Die Cast & Metal Products. The array will be pleasing

McWintz Co.'s "Handee Server" with injection molded phenolic handles combines serving spoon and fork in one utensil

Gay numbers for carrying drinks! Both trays, made by Nuanka Products Co., have Lucite handles, sides and compartments

There is no warping or blurring of pattern in Plastext Co.'s place mats. Design is silk screened between two rigid Vinylite sheets



Like a directional sign, the Gits Molding Corp. switch plate acts as a guide to the location of the electric light switch. The phosphorescent Lustron or Styron used in the molding of the plate cause it to glow in the dark after exposure to artificial or daylight

Being tied to Krene apron strings would seem to be more of a pleasure than a form of drudgery to most housewives. For aprons such as this are lightweight, can be easily cleaned with a damp cloth and are designed in the most delightful of styles and colors

MEDICAL APPLICATIONS

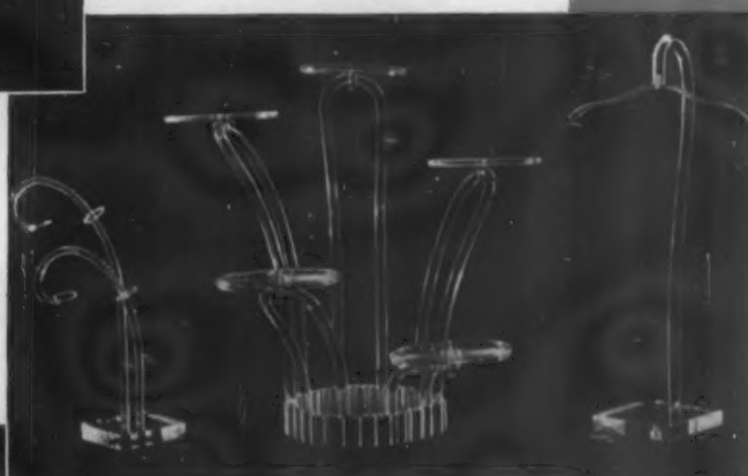
A pharmaceutical item with a good deal of merit is Victor Metal Product's black Lumarith pile pipe. Its vertical lines are molded in. This method of production not only eliminates the drilling operation involved in the fabrication of many pipes but gives the pipe a smoother surface

Easy on the eyes, this eye cup injection molded of cellulose acetate by H. Jamison has a syringe attachment. Three plastic pieces—cup, distributor and short length of tube are secured by acetone. Ballco assembles and distributes the item

Business uses

Handsome companion pieces for a busy desk are the Swivodex pen holder with Beetle base and cap, and Autodex telephone index with case of the same material. Available in matching or contrasting gay colors, they will brighten most any corner. Both are products of Zephyr American Corp.

A convenient carry-all for the cigarette smoker. The case with deep telescope top is molded of Poly-T, du Pont's polyethylene, by Tupper Plastics, Inc.



All manner of shapes and sizes are represented in the Lucite display forms marketed by Scheuer Art Metal Mfg. Co. A secret to their success is the fact that many parts are interchangeable allowing for variety

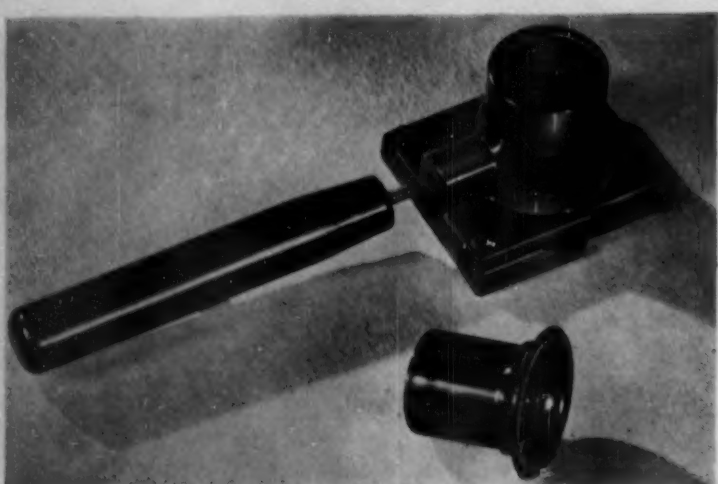
Gas pump signs for calculating costs of "filling 'er up" have been encased in Plexiglas holders. Their chief advantage is a guarantee against rust. Ten Hoeve Bros. fabricate the holders and supply changeable price listings

P L A Y T I M E

Keeping in tune with modern developments, these radios are equipped with Lumite screen grilles. International Detrola Corp. uses this screening in its table sets because it is not a sound barrier, it wears well and it is easily cleaned

Outdoor fans should enthuse over this portable tent. Neath the 20-mesh nylon screen a healthy tan can be acquired—pull down the canvas cover for sleeping. Manufacturer is Chandler Industries, Inc.

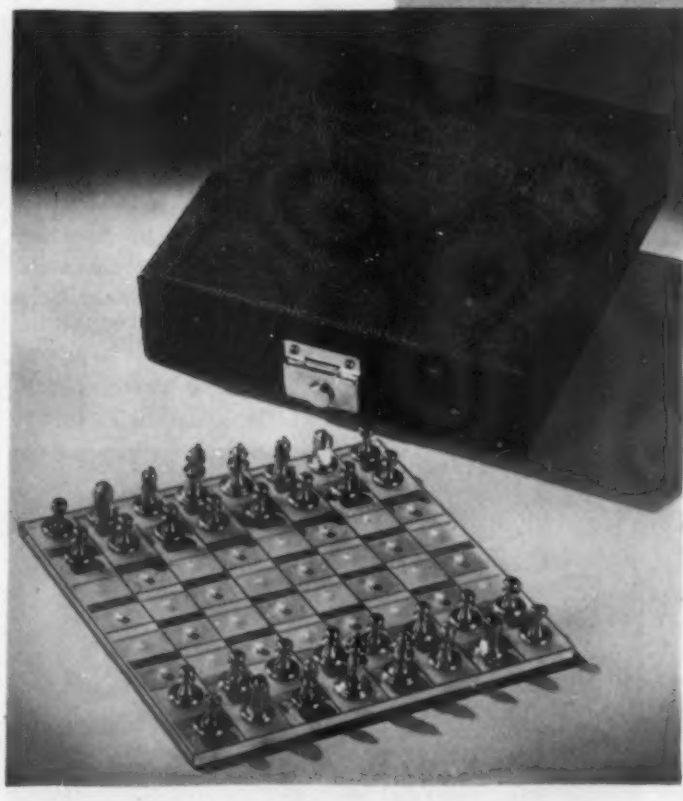
Look 'em over in a 35-mm. viewer. Films are scrutinized on a transparent Lumarith screen; other parts are molded of same material by Boonton Molding Co. for Kimac Co.



Mom takes a spin with Junior's top. It has a holder molded of Styron by Perfect Plastic Products and a spinning body of the same material molded around a steel form. Colors are effected by printed disks

PLASTICS

Almost as light as the proverbial feather, the Heath Co. airplane floats are tough too. Selectron is used to impregnate the glass fiber of which float is made. Molded in 2 sections, parts are assembled with no protruding rivets to cause drag. Floats may be used on either side of flying boat and damaged parts can be replaced



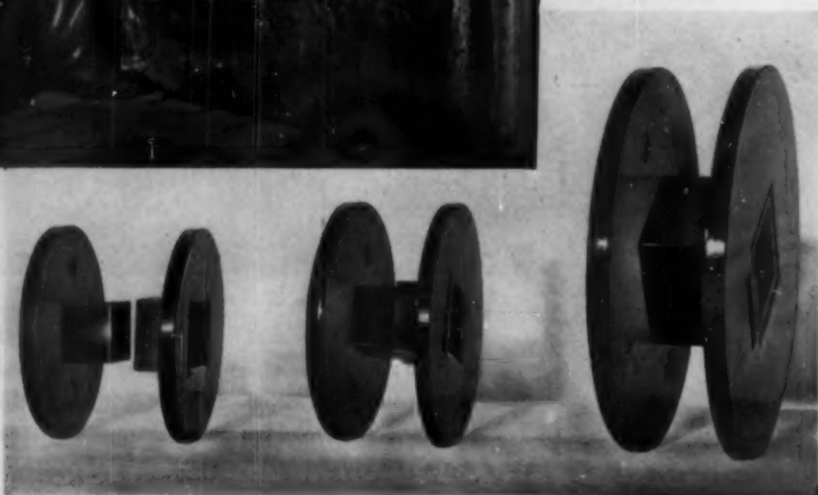
Acrylics and metal combine their artistry to produce this traveling chess set with the modern air. Made by E. S. Lowe Co., Inc., the Lucite board has checkered design silk screened on with white paint and holes drilled to hold the streamlined chessmen securely in place

A steer in the right direction are these airplane control wheels finished by Scott Aviation Corp. who dip the aluminum castings in Tenite II gel lacquers. The coating, which is chip-proof does away with polishing and finishing operations and leaves a gloss finish without traces of flash or other markings. Lettering is stenciled on the lacquered surface

INDUSTRIAL APPLICATIONS

Coveralls are an essential part of the equipment for many an industrial worker. The more resistant to acids, solvents and abrasives, the more useful they are. This black Koroseal suit not only has these qualifications but is lightweight and tough as well. Jacket and pants may be purchased separately

Brush stud insulators for DC motors are now molded in one part by the Plastics Div. of General Electric Co. A single molding is made possible through the use of high-impact Textolite which permits molding of thin walls at close tolerances and gives adequate strength to hubs



One by one oranges are counted as they travel on a conveyor belt under a Tenite II paddle. Equipped with electrical apparatus that records the count, the mechanism relieves someone of a tedious job. Southern California Plastics Co. does molding for Food Machinery Corp.

One of the first tension pulleys to utilize a plastic housing. Used to keep yarn taut on cotton spindles, it is molded of medium impact Durez by Plastomatic Corp. for SKF Industries, Inc. Resistance to corrosion renders the plastic particularly effective

Piping light with acrylic materials

by HENRY PEARSON*

IT HAS long been known that colorless transparent materials such as optical glass or fused quartz will carry light from one point to another—even around corners and curves—but until the development of the acrylic plastics, applications for this light-piping effect were strictly limited. Residual color in ordinary glass absorbs much of the light if the path of travel exceeds a few inches, and the special types of glass and other colorless materials are restricted by cost or other factors to a few special applications.

These restrictions to light-piping are removed by the acrylic plastics. Being colorless and crystal-clear, they show almost no absorption of the light passing through them; since they are thermoplastic, they can be shaped readily into any desired form, and they are, in addition, easy to machine and reasonable in price.

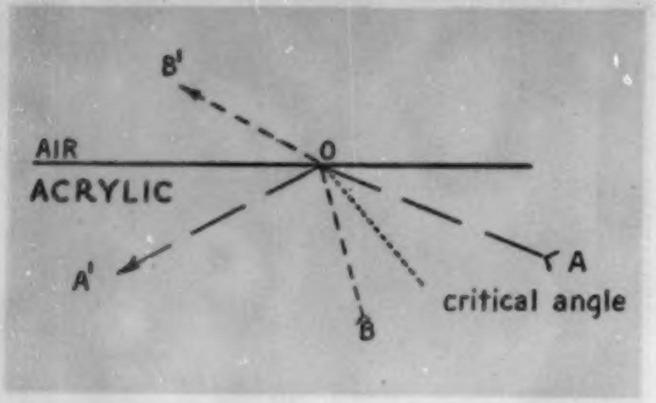
By means of an acrylic bar or rod, light may be piped to illuminate an area at a considerable distance from the source of light. Acrylic dials may be made visible by light piped from concealed bulbs; signs are spotlighted by mysterious light pouring out of the end of a transparent rod; photo-electric cells to perform all sorts of operations may be activated by light piped in a similar manner. Medical instruments of many special types use light piped through acrylic rods to give illumination, at the exact spot needed, free from the heat of the bulb.

A special application of light-piping is the effect known as edge-lighting. The distinguishing characteristic of edge-lighting is that the light introduced into the edge of the sheet is caused to leave the sheet at spots along the surface as desired by the designer. The sheet at these points, therefore, appears to glow.

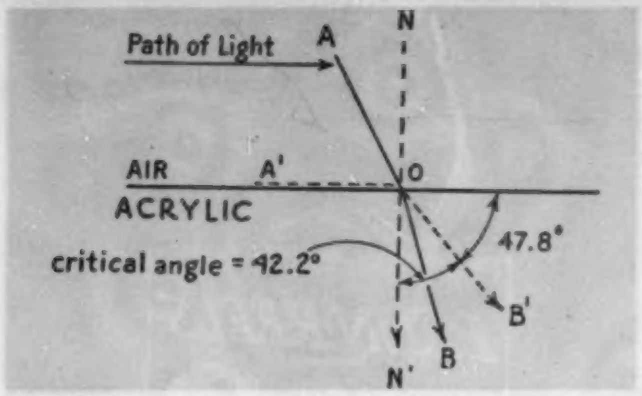
Many of the new and unusual applications for the acrylic plastic, Plexiglas, as a means of transmitting light were worked out in the Product Design laboratory of our company. An adequate explanation of the reasons for these effects is necessarily somewhat complicated, but the designer or fabricator wishing to apply the techniques will find an understanding of the basic principles of light behavior helpful. Fundamentally, the phenomenon is simple—light enters the plastic, is reflected efficiently back and forth by the polished surfaces, and remains in the sheet until it reaches the opposite edge, or until it strikes a point where the surface has been disturbed. In practice, however, there are many complicating factors involved which may lead the designer into difficulty unless he understands the primary principles of light behavior.

The internal reflections which regulate the passage of light through a transparent medium are dependent on the so-called critical angle of the material. Light passing from one material into another, at any angle other than a right angle with the surface, is bent or *refracted* (AOB in Fig. 1). As the angle of the incident ray increases, the angle of the refracted ray also increases. When a light ray in air strikes an acrylic plastic at the greatest possible angle with the per-

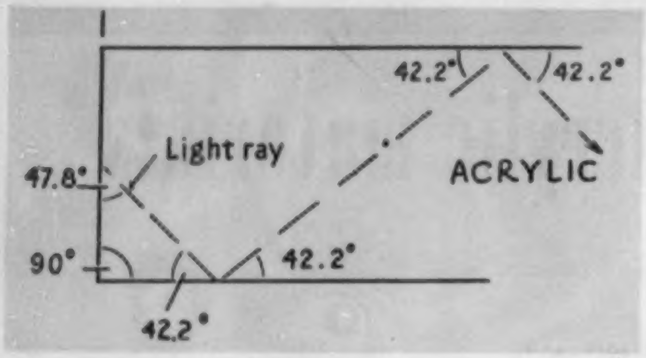
* Product Design laboratory, Rohm & Haas Co.



2—Light ray in the plastic that hits outer surface at an angle more than 42.2° with perpendicular cannot escape



1—Light, passing from one material to another at any angle other than a right angle, is refracted (line AOB)



3—If sides of plastic are parallel, reflected light rebounds from one surface to another, advancing lengthwise

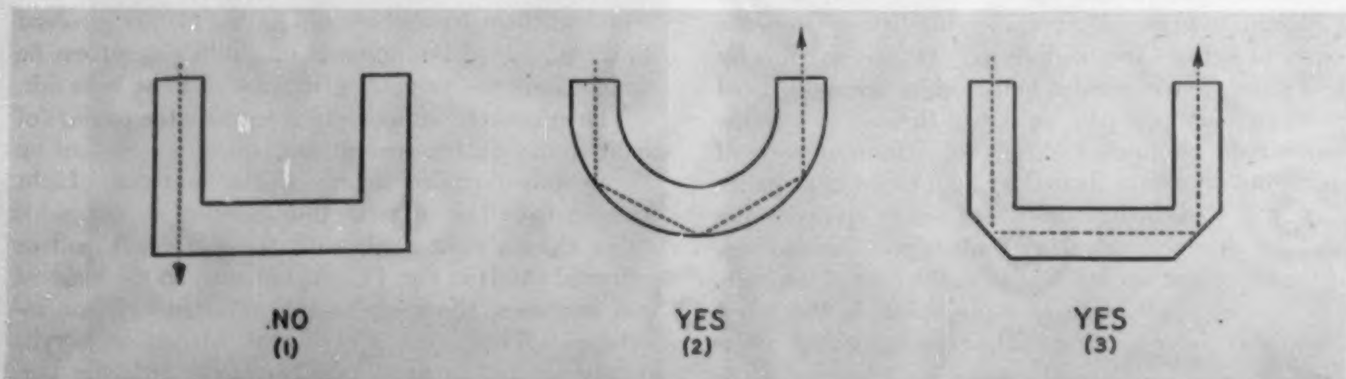
pendicular, that is, at an angle practically parallel to the surface of the plastic, it will enter the plastic at an angle of 42.2° from the perpendicular (AOB in Fig. 1). The complement of this critical angle, the angle between the ray and the surface, is of course, 47.8°.

Conversely, if the ray of light in the plastic hits an outer surface in contact with air at an angle more than 42.2° with the perpendicular, it cannot escape, but is reflected from the surface internally and rebounds, at an equal and opposite angle, within the plastic as indicated by lines AOA′ in Fig. 2. If the two surfaces of the plastic are parallel, the internally reflected rays rebound from one surface to the other, advancing lengthwise through the material but remaining entirely within it, until the edge opposite the point of entry is reached. (Fig. 3). The minimum outer radius of curvature that will carry light without serious leakage can be determined by mathematical derivation but, loosely, it is three times the diameter (or thickness) of the plastic material. For example, 1-in. rods can be bent to a 3-in. radius without important light leakage.

As explained above, *critical angle*, technically, describes the angle between the light ray and an imaginary line perpendicular to the surface. Experience, however, has shown that fabricators and designers find it more practical to deal with the complement of this angle. For this reason, in the discussion that follows, the 47.8° value has been chosen (Fig. 1).

The more spectacular effects of light-piping—such applications as *cold-light* medical instruments or mysteriously spotlighted signs—have a tendency to overshadow other important, though less obvious, uses for the phenomenon. Designers take advantage of light-piping in as simple an article as a Plexiglas jewel chest or cigarette box. In a traditional design, using right-angle corners and square bottoms, the top edges of such a piece are dull and lifeless because the light simply passes from the top edge through to the bottom as shown in Fig. 4 (1). If, on the other hand,

4—Advantage can be taken of light piping qualities by curving or beveling corners of cigarette boxes and chests



the sides and bottom (or the ends and bottom) are formed as a single curve piece (Fig. 4 (2)), the top edge will be brilliant—glowing with the light that enters one edge emerging from the other. When curved sides or ends are not desired, it is often practicable to bevel the bottom corners to 45° and thus secure considerable edge brilliance (Fig. 4 (3)).

Edge-lighting can be achieved by excluding air from a surface without actually destroying the surface. Any material which adheres tightly to the plastic, and thus excludes the air, will glow when seen from the opposite side of edge-lighted sheets. Such coatings produce the same result as sanding or engraving the surface; that is, they change the angle at which light beams striking the surface are reflected.

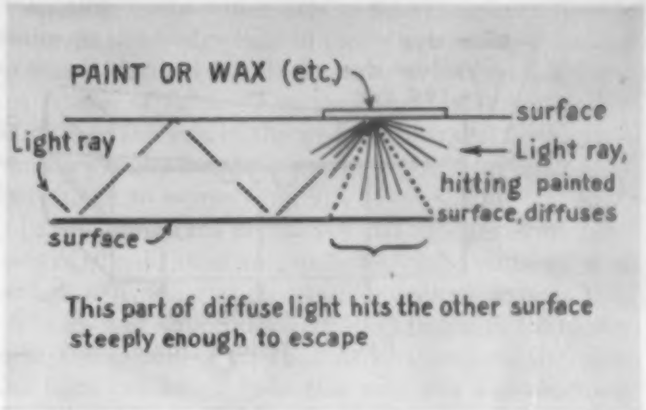
The coating or machining, being the immediate source of the escaping light, appears to glow. Obviously, since the flowing design is due to internal reflections, the design is more brilliantly lighted when viewed through the surface opposite the interruption than it is when seen direct. In the former case the light seen is reflected from the interruption and is nearly all visible, but in the latter instance, the only light visible is that which has been able to escape through the interruptions. Opaque paints are often used in producing edge-lighted designs and these, of course, *must* be viewed through the plastic.

The most brilliant effects are obtained when all possibility of light transmission is blocked, since a portion of the light in an edge-lighted panel will be transmitted if the interruption is not opaque. Machined or embossed designs, for example, may be filled with opaque pigments of proper color (Fig. 5). Unpainted, sand-blasted surfaces are brighter than simple machined areas since they are more irregular.

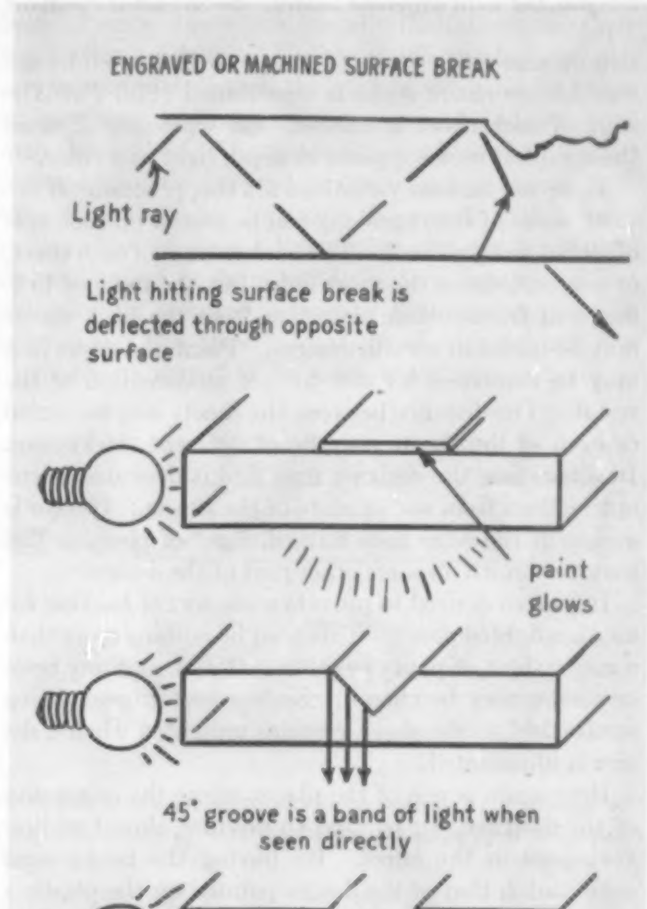
A variety of techniques are available to produce different effects. A painted design glows with a uniform diffuse light but actual cutting of the plastic surface produces sparkling highlights. An engraved line appears most brilliant, seen directly, if given a "V" profile. A "U" profile reflects a thin highlight from any angle. A square groove is not well lighted on the flat bottom, but brilliant on the less visible sides (Fig. 6).

Scribing, as distinguished from engraving, consists of closely spaced lines and is reminiscent of dry-point etching. Since these lines are microscopically rough they are evenly lighted at any angle. Highlights, in this process, are made by using masses of fine lines. Since there is always some of the original surface not disturbed by scribing, the reflection of the light is extended from one interruption to another, and a uniform illumination results. Many pleasing results are obtained by combining several techniques.

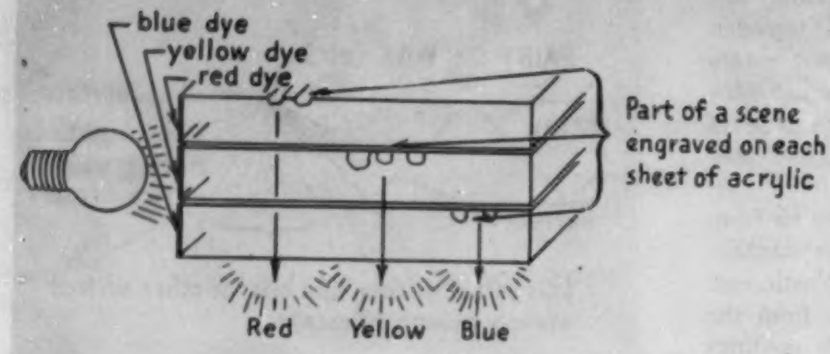
If the edge through which the light enters the sheet is colored with a transparent dye, a white painted or an engraved design, the sheet will be similarly colored. If different colors are spotted along one edge, blended colors in the design are produced. One technique, known as '*painting in light*' has been found especially effective. It is produced by engraving parts of the de-



5—Filling designs with paint or wax gives most brilliant effects when viewed through plastic since no light escapes



6—A variety of techniques may be used to produce different light effects. A few of these methods are shown here



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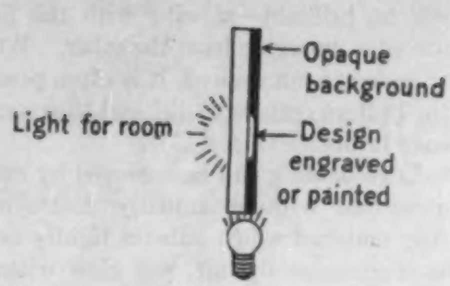


8

7—Light piping is being used in murals. Parts of a scene are engraved on successive sheets of acrylic whose edges are painted with different colors. 8—So-called "radiant walls" are another use of light carrying properties of acrylic

sign on successive sheets of plastic so that when bound together an entire scene is represented (Fig. 7). The edge of each sheet is colored, and when edge-lighted the complete scene appears in depth light and color.

There are endless variations for this process. If desired, some of the engraving can be placed on each side of all but the top sheet. The back surface of each sheet, of course, reflects the most light, but the reduced brilliance of front-surface reflection from the back sheets may be useful in certain designs. Paint and engraving may be combined for still further modification of the result. The distance between the sheets may be varied or each of the sheets may be of different thicknesses. In some cases the designer may find it desirable to cut out sections from one or more of the sheets. If color is added to the edge thus formed, light of pleasing tint may be thrown on some other part of the design.

It is often desired to provide some sort of backing for an edge-lighted panel. This need be nothing more than a single sheet of paper or other material, and any color or design may be chosen. Such a background, being unattached to the sheet, remains unlighted when a design is illuminated.

Here again is one of the places where the originality of the designer can be used to produce almost endless variations in the effect. By having the background color match that of the design painted on the plastic a sign can be made to appear or disappear as the light goes on and off. If the edge of a sheet is colored red and the design is white against a white background, the design is only faintly visible when not illuminated. When the light is on, however, the design becomes luminous in red light while the unlighted background remains uncolored and appears gray.

Another application of this principle is in interior decoration to produce the so-called "radiant walls" (Fig. 8). The surface of the wall is covered with a sheet of Plexiglas in which an appropriate design is painted or engraved. Light is given off from the surface covered by this design—enough light to provide an entire room with soft, low, illumination.

The entire surface of the plastic sheet cannot be covered by painting or engraving and still be edge-lighted satisfactorily. The design must be intermittent to allow the light to reflect back and forth between the surfaces, otherwise the light is largely diffused from the sheet through the portion of the design nearest the source and the balance of the sheet will be very dimly lighted. The less design, the more intense lighting.

The color of a painted surface also bears a relationship to the light transmission from a sheet. When light strikes a painted pattern, some is absorbed, some escapes from the sheet making the design glow, and the rest continues to travel within the plastic. The more light that is absorbed by the paint, the less there is to be reflected out to illuminate the design and to reach other parts of the design. Paint applied to a panel, therefore, should be fairly light, preferably white.

The area of decoration that can be adequately illuminated varies directly with the sheet thickness. For example, a 2-in. disk painted on $^1/_{16}$-in. material will be poorly lighted in the center, but when painted on $^3/_8$-in. material it is evenly illuminated throughout. Obviously, the thinner the sheet, the closer the two reflecting surfaces and the more frequently the light rebounds between them. Hitting at shorter intervals all available rays are diffused sooner in thinner material.

Light which is not diffused from a design in a decorated sheet normally escapes from the edge opposite the source of light. To prevent loss of this light, provision should be made to reflect it back into the sheet. In theory, this is done most effectively by mirroring that edge of the sheet. However, in most cases, the best method is to paint the edge with opaque white paint. By this means the light is re-diffused and a large portion is turned back into the sheet.

One of the difficulties in edge-lighting designs is the securing of sufficient illumination over a large area. The thickness of the material is of primary importance as is the character of the edge through which the light enters the sheet. The edge should be polished and be at right angles with the sheet surfaces. A rough, bevelled or wavy surface will transmit light into the material at angles permitting it to escape at once.

Much can be said regarding the source of light. Experiments have shown that the ideal source is a line

filament lamp with the edge of the plastic as close to the light source as possible. In practical application, however, a filament source of this type is objectionable because of the heat developed. Moreover, line filament lamps are not readily available in the lengths required in many applications. Because of these limitations, line filament lamps have been generally replaced with fluorescent tubes. The intensity of illumination produced by fluorescent lamps is less, but the tubes are practically free from heat and varied in length.

When more intense light is desired and fluorescent tubes are not practical, special methods of lighting with hot filament lamps may be devised. Line filament lamps could be used by separating the plastic from the tube with a piece of tempered glass (Fig. 10). The lamp should be placed at the focus of a metallic reflector, having a radius about one-third more than that of the tube. This reflector should be brought up around the tube, completely enclosing it except for a deep slot at the top. A piece of tempered glass placed in this slot in contact with the tube, provides the base on which the plastic rests. This arrangement secures most of the lighting value of the line filament lamp without exposing the plastic to undue heat hazard.

Another method of lighting acrylic sheet employs small incandescent bulbs. Polished holes, about an inch larger than the diameter of the bulbs to be used, are made in the edge of the Plexiglas. The centers of the holes are located at a distance of about twice their diameter from each other. In use, bulbs are inserted in the holes just far enough to give maximum illumination. Light enters the sheet all around the perimeter of the holes, and the sum of these perimeters is somewhat more than the length of the straight edge of the sheet. This method, therefore, has the advantage of introducing light on a longer surface than a single edge and a rather intense light is available. Since in this system light enters the sheet in all directions, it is necessary to paint all four edges of the sheet to keep light from escaping.

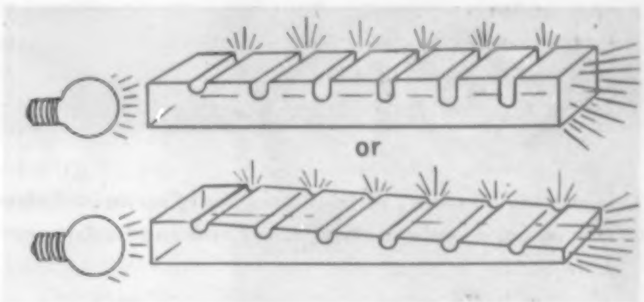
Uniform illumination of an edge-lighted sheet is often difficult to obtain, but designers can employ various devices to avoid trouble from this source. In many cases it is practicable to light the sheet on two or more edges to increase the amount of light available. In other instances, the design itself can be planned to compensate for lighting characteristics by not placing large masses of engraved or painted areas in one spot.

In a *short* edge-lighted piece uniform illumination can be obtained by making the engraving progressively deeper as the distance from the light source increases. In such a case the light that is traveling along essentially parallel lines in the small area may be a sizable fraction of the whole illumination and the progressively deeper cuts under these conditions reach successively lower 'layers' of the parallel light. Each cut, therefore, receives nearly the same amount of illumination. This device is not effective in large areas, because in such cases near-parallel light, spreading through the bigger sheet, is used to light parts farther from source.

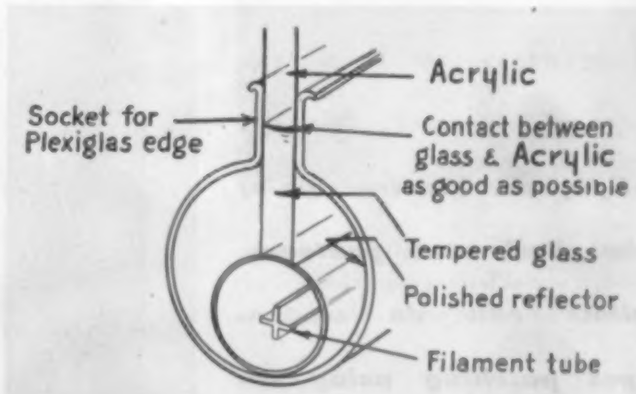
Another device which aids in providing even illumination in short edge-lighted pieces is tapering the piece so that it decreases in thickness as it gets farther from the source of light. The rays that are more nearly parallel to the axis of the wedge will travel farther before they strike the surface at an angle great enough to allow them to escape (Fig. 9).

In some cases the decorative and functional applications of edge-lighting are most effectively combined as is evident in a glance at the two illustrations on page 123. Light fixtures can combine edge-lighting with the direct light for beautiful effects. Advertisements in color and light can be made in this way and signs such as "Stop" signs or "Walk—Don't Run" signs—visible only when lighted, are practical attention-getters.

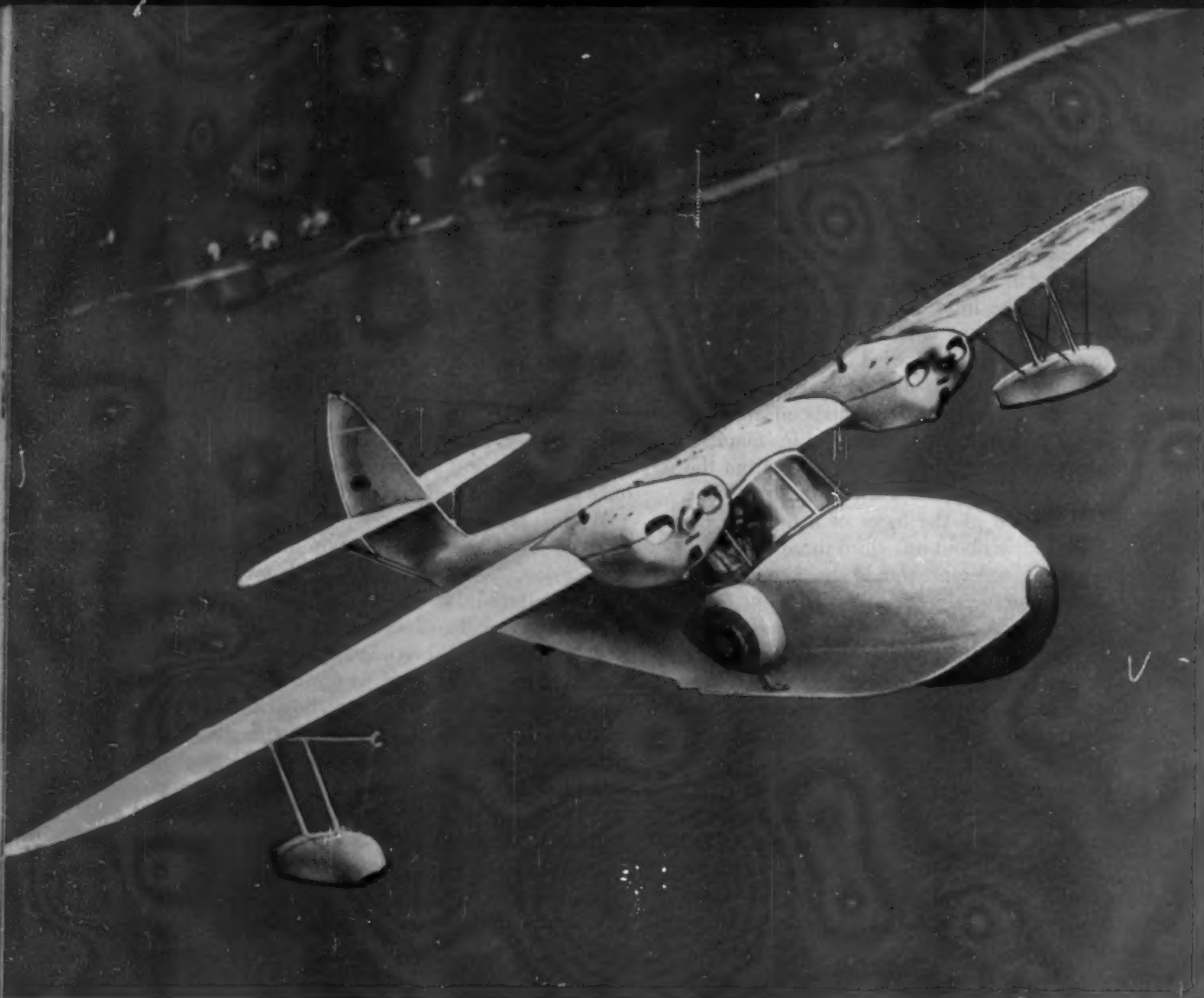
While edge-lighting and light-piping open a wide field of uses, there are certain limitations to their application. Obviously, dirt and scratches on the acrylic material disturb the surface the same as paint or engraving, and such defacement will be edge-lighted with the design. When edge-lighting is used where the plastic is greatly exposed to scratching or soiling it is sometimes desirable to cover the panels with a protective sheet of glass. Edge-lighting is also limited in its application on large outdoor signs because of the difficulty in securing adequate illumination over a large area. But these limitations of edge-lighting are negligible compared to its many useful applications.



9—Methods of engraving acrylic to provide light at edge of a tapered piece of this plastic or at edge of a long bar



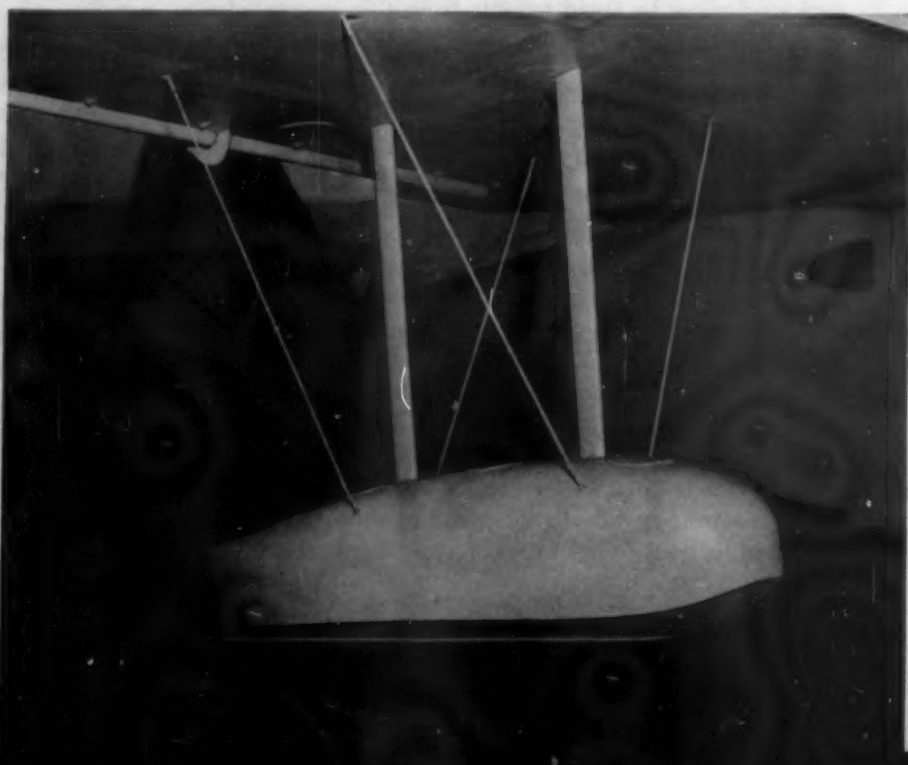
10—Line filament lamps can be used to light acrylic material if they are carefully separated from the plastic



This amphibian plane, which makes use of laminated plywood for hull and pontoons, has a cruising range of 500 miles and a flying speed of 135 m.p.h.

To keep moisture absorption at a minimum, the outside ply of the laminate used on hull and pontoons is made of phenolic resin impregnated paper. A special fungicide paint gives protection from micro-organism growths

Ease of repair is a feature of this plane. Because of plywood construction of the hull and pontoons, pilots can do on-the-spot patching using resorcinol cold-setting resins



A PLYWOOD amphibian plane

A LOT of men who spent the past four years with their noses to the grindstone, and a lot of families whose travel has been restricted, have developed spots before their eyes! Fishing spots, camping spots—any kind of spots that represent a brief release from pressure and ennui. To get to these spots is their problem, since time is still rationed for most businessmen.

Such men and their families are viewing with enthusiasm the new Trimmer amphibian now in production by Commonwealth Aircraft, Incorporated. This twin engine amphibian can land on air strips, lakes or rivers. With a cruising speed of 115 m.p.h., a top speed of 135 m.p.h., a landing speed of 48 m.p.h. and a cruising range of 500 miles with full gross load, it offers the upper middle-class family a new lease on leisure.

The plane has been under test for over a year, and Gilbert T. Trimmer, its designer, emphasizes the fact that it isn't a prewar plane in a new dress but an entirely new ship engineered and built with war-born methods and materials.

The cabin serves as the main float for water landings although a small streamlined pontoon is built into each wing. The landing wheels are designed so they retract into the side of the hull. The hull, which is produced in three sections, is a laminated plywood job, involving some new principles of lamination. Naturally, water landings place stresses and strains on the hull. To insure a specific impact strength in the finishing molding, mahogany ply is used as the base of the hull form and the moisture content of the wood is kept to six percent. Added strength is provided by Fiberglas used to reinforce the hull bottom.

The outside ply in the lamination is phenolic resin impregnated paper treated with a special fungicide. This outer coat allows a bare three-quarters of 1 percent moisture absorption as compared with 15 percent for standard aircraft plywood, and gives complete protection against micro-organisms so prevalent in inland waters. The phenolic paper comes in several colors and offers a permanent finish.

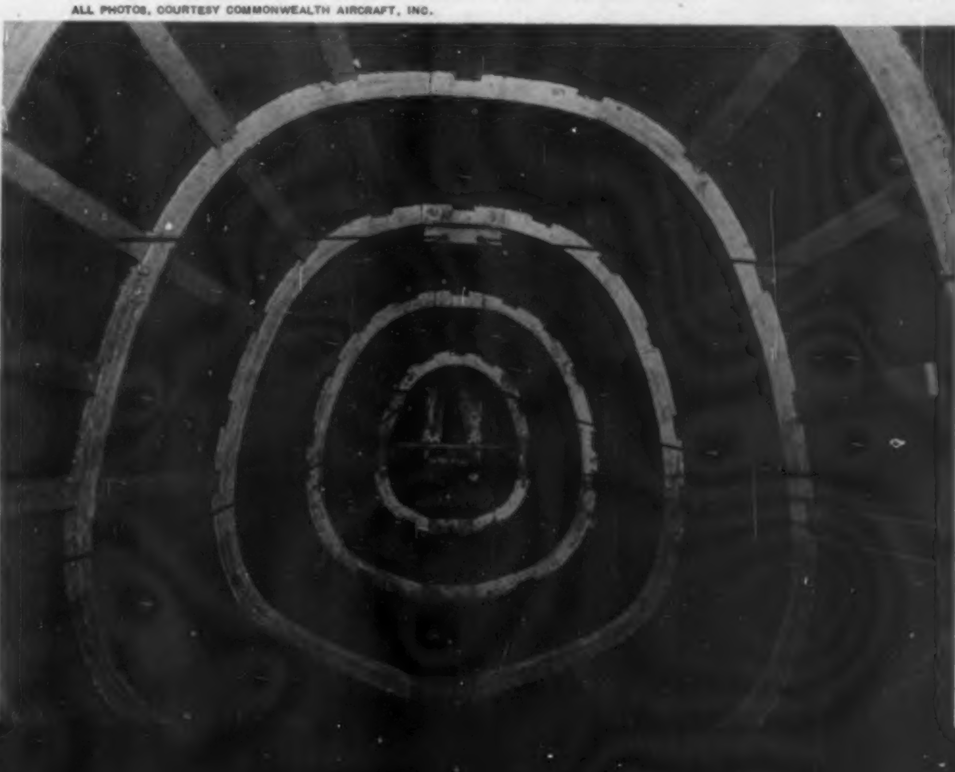
The three parts of the hull are cured in autoclaves and the sections bonded together under heat in a final assembly. The two wing floats are produced in similar manner.

The windshield of the Trimmer is of Lucite; the gas tank of Pliocel, a nylon-rubber development which has created much interest in the aircraft field. A feature of the construction is that the two engines with the gas tank between them may be lifted out as one piece, an arrangement that simplifies maintenance and repair work. Upholstery on the three seats, which may be made into two comfortable bunks, is vinyl coated and comes in colors to match or contrast with the hull.

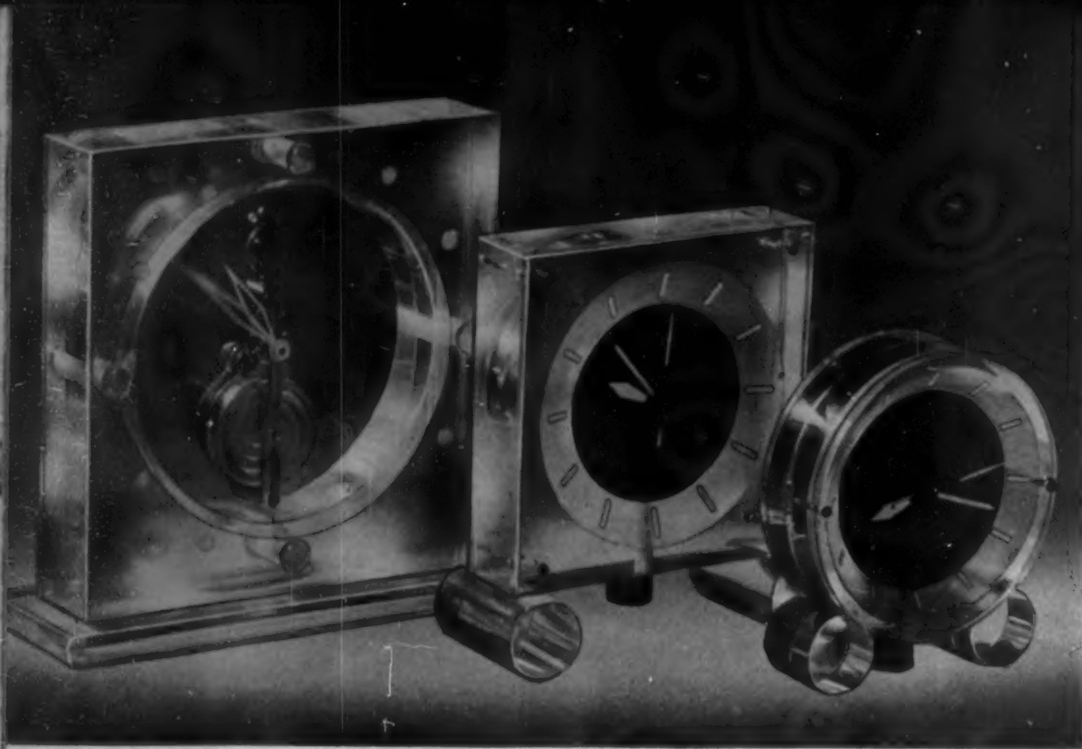
Pilots who have flown the plane are uniformly enthusiastic. Prospective purchasers automatically reach for their checkbooks. They are invariably amazed to find that its cost is about a sixth as much as prewar planes of similar capacity, power and quality. The plastic construction and the careful engineering that has gone into the ship are the reasons.

Above—Wing tips are formed by drawing a resin impregnated fabric tightly over framework and fastening in place

ALL PHOTOS, COURTESY COMMONWEALTH AIRCRAFT, INC.



Left—A view of the hull interior, from the center towards the tail, shows the framework and laminated structure



1—*Acrylic was used in the housings of these 3 unusual clock designs because of its clarity and its sparkling brilliance. These show a happy alliance of plastic and metals*

Combining plastics with other materials

Molded plywood is typical of the combinations that designer and manufacturer have yet to exploit in full

by ROBERT C. SCULL*

THE plastics industry came out of the war with new materials, new methods and new applications. That's on the credit side. But it also gathered a small harvest of products that should never have been made of plastics or, at least, should have been made of a different plastic material.

When metals and woods were scarcer than humming-bird tongues, the newspapers and magazines throughout the country extolled the virtues of plastics, which they too often described as an excellent-to-replace-anything material. This campaign succeeded too fast. Too many manufacturers rushed for plastics without being ready for them.

Not a substitute

The truth is that plastic, like metal or wood, is no substitute. It is a material in itself and its future today lies in the hands of American manufacturers. Each plastic has qualities, beauty and advantages peculiarly its own. It also has its disadvantages. But, once understood, these disadvantages can be discounted. Plastics cannot, however, be used indiscriminately any more than wood can always be used in place of steel.

The proper use of plastics extends beyond the question of whether a product should be made of plastic to the matter of which plastic should be used. Unfortunately, there is a tendency among manufacturers and the public alike to think of plastics as one material. They must learn that, like wood and many other materials including metal, there are many different kinds of plastics with many different properties and characteristics, capabilities and limitations. Unless they do this, one plastic item made from the wrong type of material may cause the public, and a manufacturer, to condemn all plastics.

How often has a manufacturer, sold by the "wonder material" publicity plastics have received, simply said at a conference on a new product, "I want it of plastics, every inch of it." And how often has his industrial designer, penny-wise and pound-foolish, produced the all-plastic item without explaining why the use of plastics throughout this particular product was impractical. It might well be that this was one of the many instances when plastics in combination with another material—wood or metal, perhaps—was the ideal solution.

The use of plastics in combination with other materials is a trend which should be studied with considerable care by all industrial designers. Quite a bit

* Martial & Scull, industrial designers.

of headway was made along these lines during the war, and the freeing of materials from restrictions and their greater availability should result in many interesting, and important developments during the next few years.

Resin-bonded plywood

Consider resin-bonded plywood. One of the finest examples of plastic used in combination with another material, it can and should be used more frequently on the American market. With a little ingenuity an industrial designer can plan beautiful, inexpensive, comfortable and useful plastic plywood tables, pianos, chairs, beds, wall paneling, or decorative applications. True, photographs of futuristic chairs and other isolated pieces of molded plywood furniture have appeared from time to time, but designers as a whole are guilty of omission. They have not pointed out to their clients the variety of ways in which this material can be used.

Resin-bonded plywood has a long life, wears well, is easy to clean and can look as expensive as the best mahogany. More specifically, its advantages can be listed as follows:

1. Plywood furniture can be manufactured by mass production methods. This gives it a distinct edge over long-familiar wood furniture.

2. Because mass production cuts manufacturing costs, this plywood furniture is capable of being produced in large quantities at a lower price than comparable wood furniture. And a lower manufacturing cost means a lower selling price.

3. As prices are reduced, new and larger markets will be open to this plywood furniture.

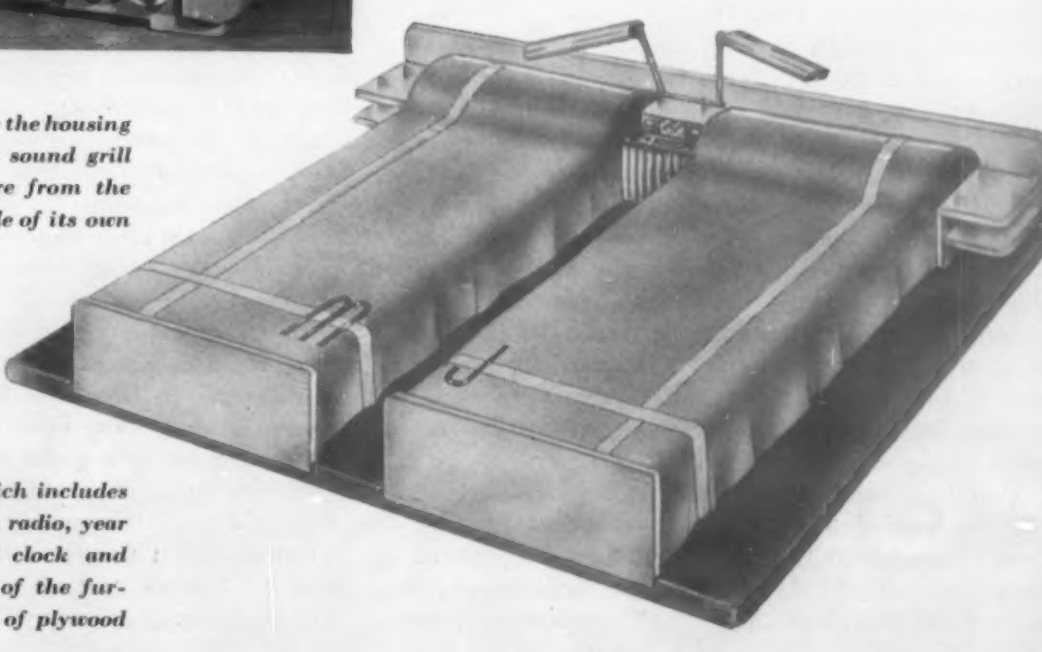
4. The furniture, besides being durable, can be designed in a variety of shapes.

As material of all types become more available, designers should not lose the opportunity of trying out the many possible combinations of plastics and other materials. Rather than a limiting of the use of plastics this will mean its introduction into many fields where it cannot be used alone. And, conversely, the color and texture so characteristic of plastics will serve to enhance the materials with which they are used and, consequently, the end product in which the combination is employed.

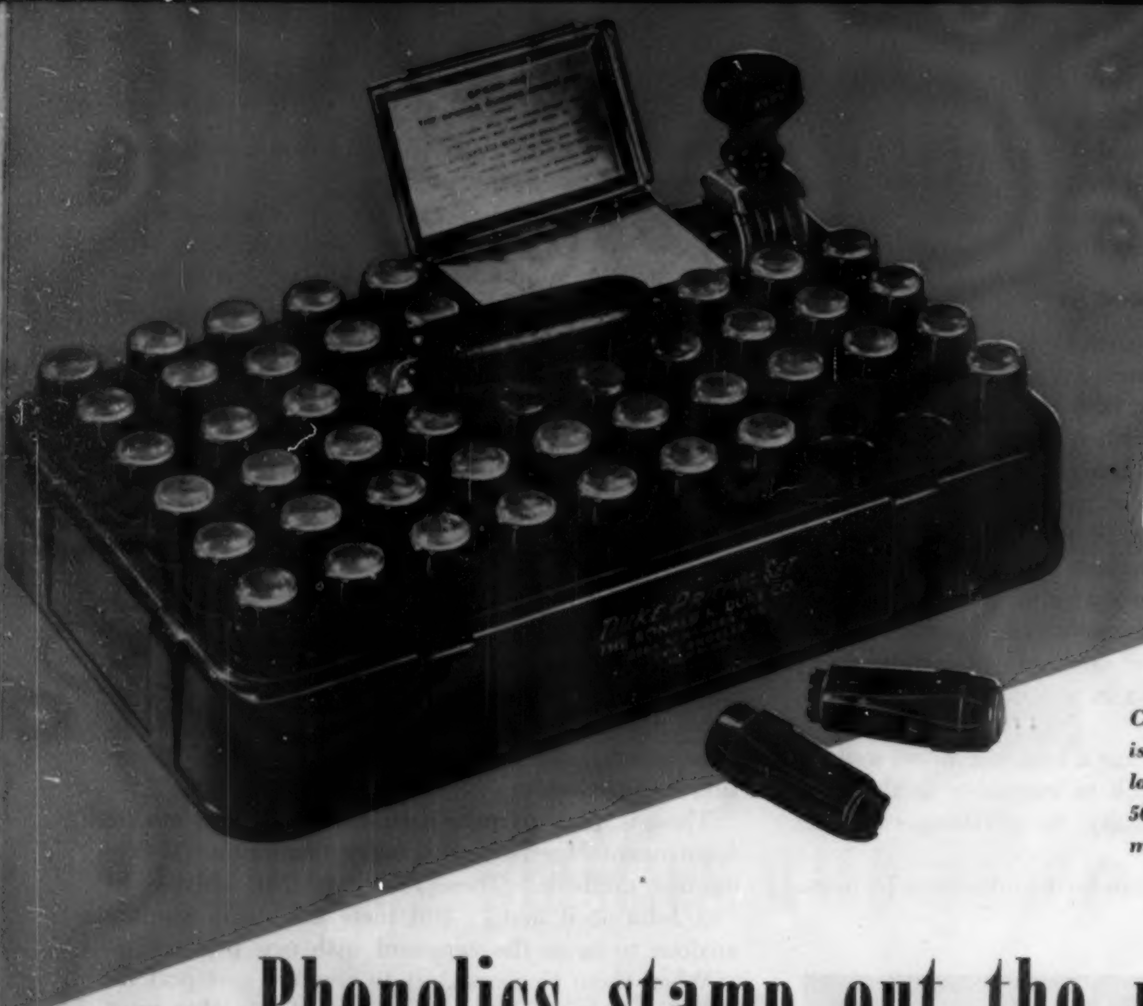
There is, perhaps quite naturally, a tendency among some manufacturers to stick to tried materials and production methods. These men take the attitude of "let John do it first." But there are others who are anxious to be in the vanguard with new products.

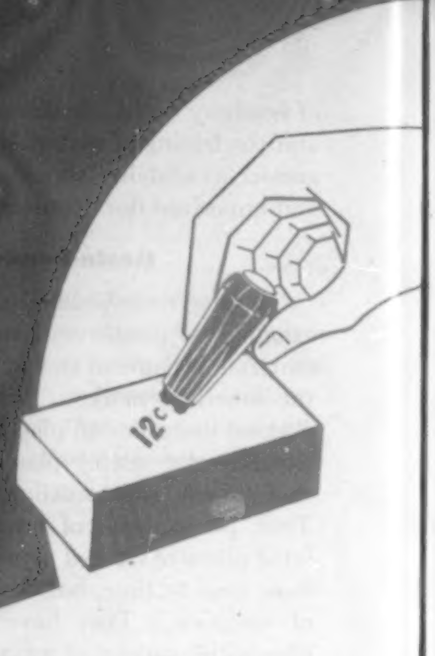
When these pioneers start to create a new part for their line, whether it be all- or part-plastic, they must keep constantly in mind the production problems. The artist's most beautiful rendering is useless if the production man cannot produce the article thus depicted. And the most beautiful hand-made article is of no value to a large-scale manufacturer unless he can turn out the parts by the thousands in his factory. From the inception of an idea, the artist or designer should keep modern production methods constantly in mind and work out the sketch or model so that the shape of the article, besides being functional, is suited to the material and to the manufacturing technique.

2—Plastics alone comprise the housing of this table radio. The sound grill is an attractive departure from the louvers type, having a style of its own



3—This twin bed set, which includes adjustable reading lamps, radio, year calendar, electric alarm clock and shelves, is representative of the furniture that can be made of plywood





Cotton-flock-filled phenolic is the material used for this labor saving pricing unit with 50 molded-in wells to hold the molded polystyrene stamps

Phenolics stamp out the price

UP-to-the-minute merchandising methods demand clear readable price marking. In many stores, the time-consuming grease pencil, so long used to mark the price on cans and packages, is being abandoned in favor of a compact marking kit comprising a molded phenolic rack holding 49 individual price-making stamps, a mechanical adjustable band number stamp and a stamp pad.

Developed by Ronald K. Duke of Los Angeles, this marking equipment made its first appearance during the war. Originally it was constructed entirely of wood—even to the handles of the stamps themselves. But wood was easily soiled by the ink on the stamps and almost impossible to clean. Another disadvantage of wood was the work involved in making each rack.

After experimenting with a number of materials, Erick Marx, consulting engineer, specified a medium impact cotton-flock-filled phenolic for his redesign of this marking equipment. This meant plastics for the stamp handles as well as for the holder itself. The deciding factors in the selection of this particular plastic were high tensile, flexural and impact strengths, good molding qualities and smooth finish which does not show ink stains and can be cleaned.

Despite the skepticism of one molder who declared that the housing of this stamping equipment could not be molded successfully due to the large number of stamp wells (50 in all) and the comparatively large size of the piece, California Plastic Moulding Co. is now compression molding the stamp rack in a single-cavity mold.

The design of the price stamps, which contain two polystyrene parts and were styled by E. H. Daniels Associates, constitutes a distinctive improvement over the old-fashioned wood-handled stamps. Assembled from four component parts—a solid rubber die, printed identification tab, black polystyrene handle and transparent polystyrene cap—the new stamp is water-tight.

Southgate Tool Engineering Co., who molds both plastic parts for the stamps, employs a stripper plate 16-cavity mold in the production of the transparent caps. The unusually high rate of 135 shots per hour is attained in these pieces through the expedient of using a mold in which the cores are in the hot half. For the black polystyrene handles, this same molding company uses a 12-cavity mold.

The stamping kit is supplied with a bucket-type bail for hand carrying which fastens into sockets molded into the top of the housing. Although it can easily be removed, the bail is locked in an upright position by spring tension and is so placed that the stamping equipment is perfectly balanced when filled with its complement of stamps. The unit can also be attached to a stock cart by two metal hanger brackets. These brackets are easily screwed to the stamp rack through slots molded into the rear wall of the housing.

But whether it is carried by hand or permanently fastened to a stock cart, this stamp kit is proving a boon to the progressive grocer.

High fidelity in model trains

by MARSHALL FRISBIE*

THE romance of scale-model railroading lies in its realism, and by the use of plastics the A. C. Gilbert Co. has brought realism to new heights both in appearance and operation.

Gilbert designers work from blueprints of locomotives and rolling stock used by major railroads and so are able to produce actual scale models, reducing the specifications to exact $^3/_{16}$-in. proportions. Plastics permit greater authenticity in reproduction of cars than either die-cast or pressed steel.

Fidelity of detail is but one of many advantages plastics offer. Weight is another. A plastic car weighs one-third as much as the old die cast car, and instead of a six- or seven-car train the new American Flyer now pulls 14 or 15 cars. The result is greater realism in the length of the train itself. What enthusiast, young or old, does not get a greater thrill from a 10-ft. train than from one only four feet long.

Plastic car wheels cut to a minimum the objectionable noise of the old metal wheel and instead give the click-click effect of a real train in motion. Chalk up another point for realism.

Plastic cars are easier to manufacture. They have greater permanence and durability and can withstand heavy impact. Despite the lighter weight they are far less fragile than those of die castings. Their colors are fast, giving the car the warmth of realism, and there is no paint to chip or peel off. An important safety factor is the absence of cutting edges on which a child might injure himself.

There was yet another reason for this company to turn to plastics. When the new model American Flyer, equipped with a device that puffs real smoke synchronized with actual choo choo sounds, went to a two-rail track, it was necessary to use some good insulating material for wheels and couplers. The answer—plastics.

Long before the war, this model train manufacturer pioneered in plastics and work was continued during the war in products made for the Army and Navy. Thus the company built up a considerable know-how and acquired necessary equipment for mass production of miniature railroad cars and other rolling stock.

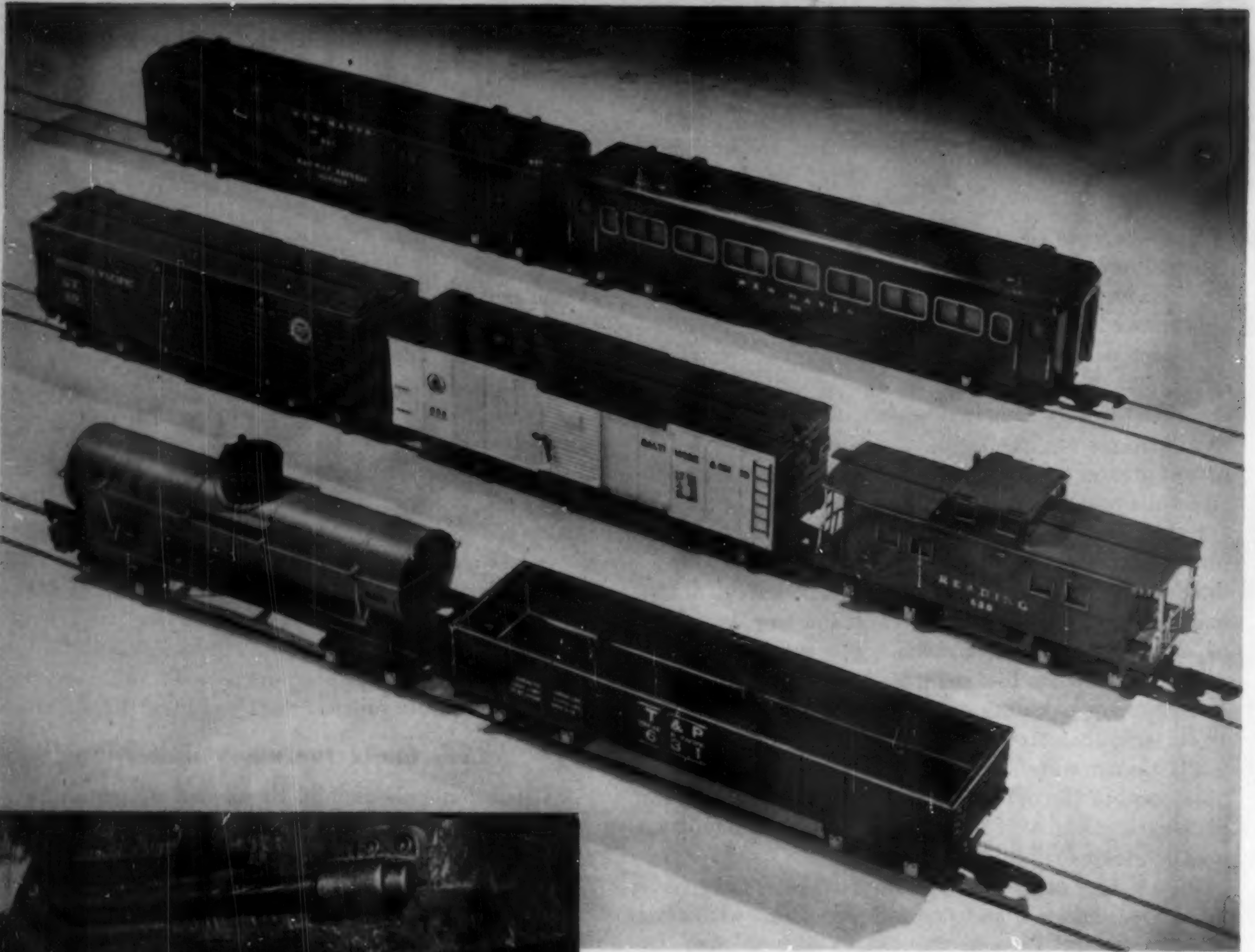
Uses found for many materials

Both thermoplastic and thermosetting materials are used. The development work with thermoplastics was carried on with the cooperation of Nixon Nitration Works and Celanese Plastics Corp. and original production made use of the high acetyl cellulose acetate of these two companies. It is easy to mold, free from warping, doesn't crack and withstands high tempera-

* Chief engineer, A. C. Gilbert Co.

1—New lightweight plastic cars, one third the weight of old style die-cast cars and built to 3/16 in. scale of the real thing, give the American boy 100 percent realism in the design and operation of his model railroad

PHOTOS 1 AND 2, COURTESY CELANESE PLASTICS CORP.



2—These cars just off the assembly line show the wide variety of available minature models—baggage, passenger, freight, tank, coal cars and a top favorite, the caboose

3—The bodies of all the cars in these model trains are injection molded of thermoplastic materials. Here, two tank car bodies are being removed from the 2-cavity mold used for this particular piece. For other parts of the equipment, dies with as many as 40 cavities are employed. From the press, the bodies go to the assembly room

tures. As production requirements increased, the A. C. Gilbert Co. supplemented this high acetyl cellulose acetate with cellulose acetate supplied by Monsanto Chemical Co.

Phenolic materials, both Durez and Bakelite, wood-flour filled, are used in switches, cross-overs, automatic track sections, control boxes for switches and roofs of stations—to mention a few of their uses in model rail equipment. A thermosetting material is used where dimensional stability is of the utmost importance.

The process of manufacturing a thermoplastic car body begins with the machining of a model, based upon blueprint proportions. A mold is then made and used in an injection molding machine which has approximately a 20-second cycle. Other parts are molded in multiple cavity dies with from 2 to 40 cavities.

But the injection molding of car bodies is only the first step in the production cycle. If they are Pullman or passenger cars, windows are then inserted and cemented on as they move along the assembly line. The windows are formed by a strip of acetate material that fits on the inside of body and over the window

apertures. Strip is so designed in color to give realisitic effect of transparent as well as frosted window panes, with curtains and shades drawn to correct levels.

Mass production assembly

While this process is going on, plastic wheels and axles are automatically assembled in a hopper feed machine. This is a mass production step in itself. Two mechanical plungers press the wheels on the axles at the rate of 100 sets per minute. The axle assemblies are inserted into the trucks, and the entire truck assembly is fastened to the chassis by a single rivet. The completed chassis is then cemented on the car body and the lettering on the car is die-printed. The entire car body is now ready for packing and shipment.

Pullman and passenger cars and cabooses may require interior illumination. In these cases, alternate wheels of brass are used with plastic. This is necessary because of the American Flyer's two-rail track, one set of brass wheels picking up the current from one rail and the other set picking it up from the opposite rail and transmitting it to the light bulb.

Only the locomotive and tender are still made of die cast or pressed steel, yet in these two units plastics also play a highly important part. In the locomotive, for example, plastics are used at three points: 1) front and rear truck wheels are all plastic; 2) a ring of plastic is used to insulate all driving wheels; and 3) the brush end of the motor bearing support is plastic.

The plastic insulating ring is pressed between the metal flange and hub of the driving wheels. This prevents the current in the track from being short circuited by the locomotive. In addition, this acetate ring is white in color, contrasting sharply with the black of the locomotive and giving still another touch of realism.

Car colors copied in thermoplastics

The use of thermoplastic materials for car bodies, it should be added, permits the faithful simulation of actual car colors. The deep greens, reds, yellows and other hues of the many Pullmans, passenger, freight and tank cars of the major railroads, are all reproduced by Gilbert. Nothing is more important in scale model railroading than accuracy in detail, even to colors. Plastics afford that "just like real" look.

Gilbert has used thermosetting materials for some time. Several years ago the company brought out its HO gage scale model railroad. The roadbed of the HO gage track was, and still is, made of Bakelite thermosetting material. This roadbed is $^5/_{16}$ in. high and $1^1/_2$ in. wide and is made in sections up to $8^3/_4$ in. in length.

As in the case of car bodies, blue prints are followed for accurate scale in all American Flyer equipment. For phenolic materials, however, a compression-type molding machine is used. This operates on a cycle of from $1^1/_2$ to 3 min. and is used in the manufacture of switches, cross-overs, automatic track sections, control boxes and other plastic components.

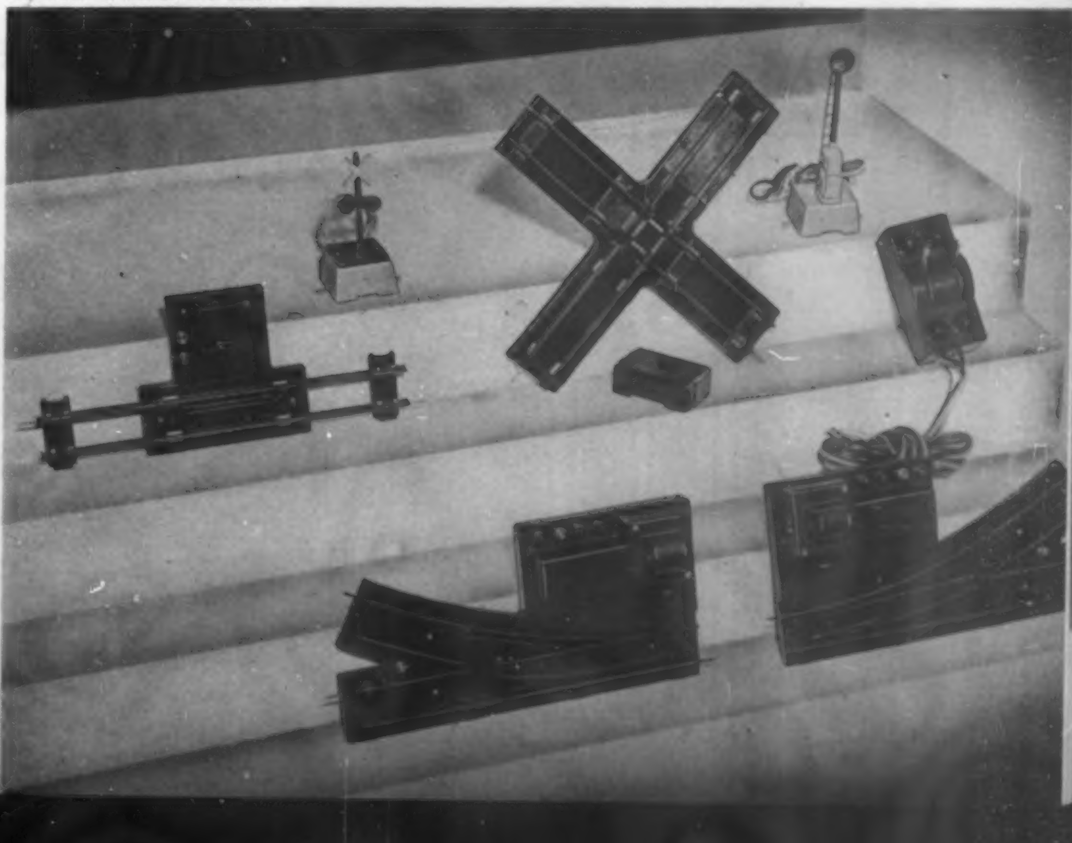
Still another plastic used by this company is Lucite. Acrylic rods are excellent for the transmission of light from a central source in both signal lights and headlights of locomotives. It makes for greater realism, too.

You still may find on display some old type locomotives with the headlight bulb jutting from the front, all out of proportion to the locomotive itself. With an acrylic rod, light is transmitted from within the locomotive to the head light and thus the headlight is in exact scale proportion to its size on a real train.

This model train manufacturer has found uses for plastics in its other lines of scientific toys. New chemistry sets now come with phenolic caps for bottles. A polystyrene lens is used for base plates and other parts of electrical sets.

The proper plastic material must be used in the correct place. It requires correct design, good tooling and skill in production; and research goes on constantly. Through use of plastics, this company has brought realism in miniature railroading to new heights.

PHOTOS 3 AND 4, COURTESY A. C. GILBERT CO.



4—Even train equipment is made of plastic. Left is automatic coupler device also showing new 2-rail track. At top center is crossover. Just below is control-button box. Semaphore switch, block signal have methyl methacrylate rods which transmit light

1

2

Polystyrene and ethyl

Color and stability of plastics are important factors in sales appeal of new door chimes

THE postman, the baker, the laundryman, Junior's music teacher and the members of the ladies' bridge club are lucky. So are the thousands of home owners now installing musical door chimes, for the first postwar chimes are much improved in appearance and operation—thanks to the ingenious and extensive use of plastics.

Three things are vital in chime manufacture: tonal quality, efficiency in operation at all times and beauty that will be durable. In all three, the proper use of plastics is a factor. Just how plastics make these important contributions is clearly evidenced in the new models recently introduced by two large companies in the field, NuTone, Inc., and A. E. Rittenhouse Co., Incorporated.

NuTone uses plastics in four models. Two of these chimes, the K-14 Skyline and the K-16 Commander (Fig. 1), have housings molded of white or ivory Styron; the housings for the other two models, the K-28 Imperial and the K-32 Continental (Fig. 2), are of white ethyl cellulose. All four are molded by Elmer E. Mills Corporation.

The metal decorations used on the housings are held in place by clips which are turned back on the underside of the piece after being inserted through holes in the plastic. In most cases these holes are molded in; in some they are drilled in later.

The dimensional stability of these housings, their integral color, ease of cleaning and light weight are popular qualities. Since the chimes are shipped in multiples of 6 units, the lightness of the plastics gives these chimes some advantage, from the standpoint of shipping cost, over units made entirely of metal.

3

1—White or ivory polystyrene is used in molding chime housing. 2—Ethyl cellulose, used here, is equally effective

3—Plungers that protrude from each end of the power unit and contact the bell coils within, are extruded polystyrene

cellulose *chime housings*

Tests prove that there is no apparent tone difference between metal and plastic housings.

The power unit (Fig. 3), which houses the coils and actuates the plungers when the door buttons are pressed, contains two plastic applications. The plungers are of extruded polystyrene supplied by Superior Plastic Products. Prior to the war, reed was used for this purpose. When it was no longer available, wood and metal were considered. Wood was found to pack down on repeated impact; metal plungers were found to produce too harsh a tone. So NuTone, Inc., finding the polystyrene plunger satisfactory from all standpoints, has made it a standard part of its assembly. The power unit also has a Bakelite terminal board molded by Recto Molded Products, Incorporated.

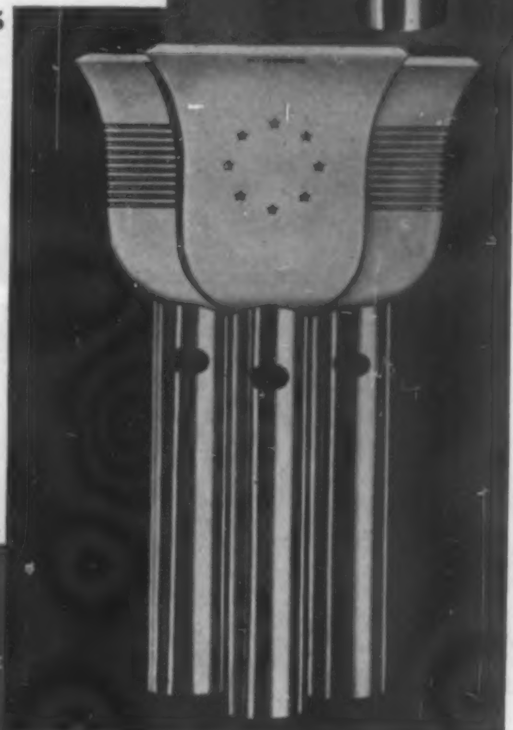
The A. E. Rittenhouse Co. has five chimes in its line with housings molded from polystyrene. The Dorset and Sheraton are molded by National Organ Supply Co.; the Sheffield by General Electric Co. The other two models, the Newport and Beverly (Figs. 4 and 5) come from Norton Laboratories.

A mold design problem in connection with this housing was solved by the molders in a very interesting way. In the first place the housing is a pretty big piece and had to be gated where it would not show. Had the gate been centered at the back, the material would have had to flow down, across, and up into the fairly thin mold cavity. Quite possibly either a flash or a flow line mark would have thus been created. Also, this company desired one mold for both two or three chime models.

Figure 6 shows how the problem was solved. Where the gate meets the piece, the wall is the same thickness as the whole molding, but an indented semi-circle provides space for the third chime. For 2-chime assembly the gate is cut straight across; for 3-chime assembly it is cut along the outline of the semi-circle.

4

5



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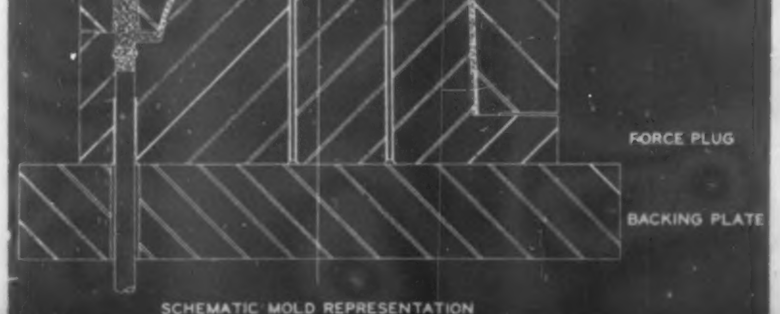
FIGS. 1, 2 AND 3, COURTESY NU TONE, INC.
FIGS. 4, 5 AND 6, A. E. RITTENHOUSE CO.

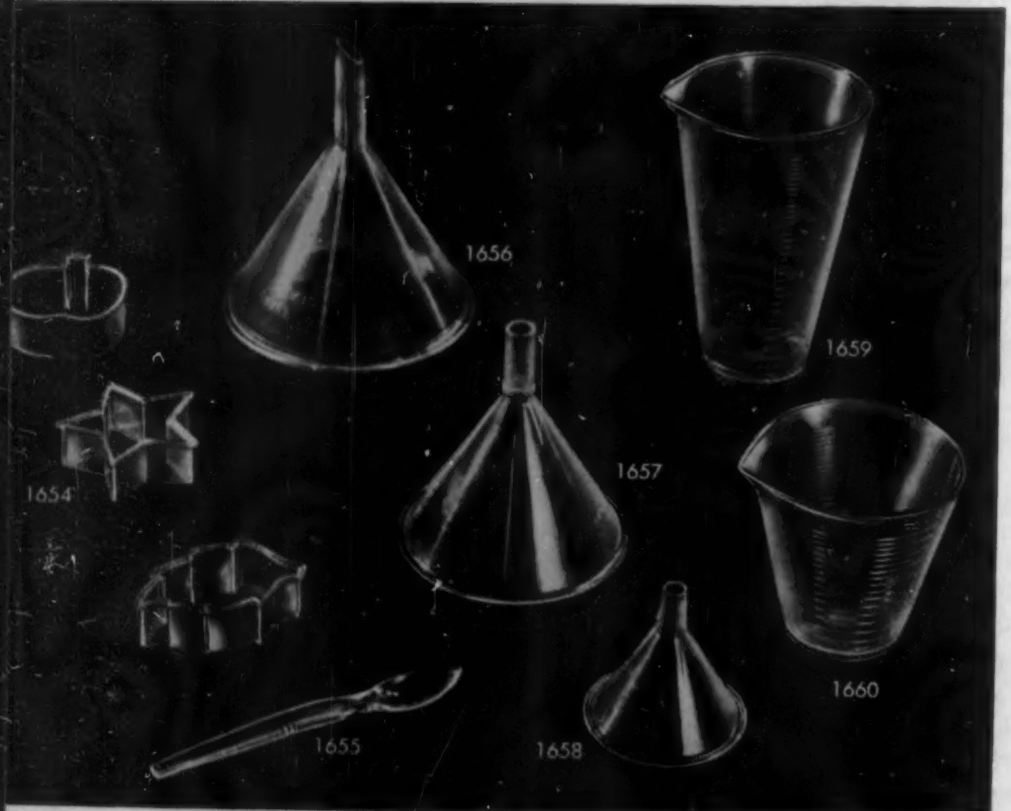


4 and 5—The same housing can be used for 2- or 3-toned chimes. An indented semi-circular section, molded in the bottom of the unit may be knocked out to make room for a third chime. 6—A blueprint of the mold for the above housings shows flow of the material into the cavity

Plastics Stock Molds*

SHEET ONE HUNDRED FORTY

Assorted household items such as funnels, cookie cutters, coasters, ash trays, poker chips, suitable for premium and advertising use, are available from stock molds without mold cost. Additional information, manufacturers' names and addresses may be obtained from the Stock Mold Div., MODERN PLASTICS, 122 E. 42nd St., New York City 17, N. Y. Please state sheet and item number



1654. Transparent cookie cutters: available in 3 shapes.

1655. Fruit spoon with tooth-edged bowl. Separates fruit from peel

1656. Transparent pint-size funnel. Overall diameter $4\frac{7}{8}$ in. by $6\frac{1}{2}$ in. long. $\frac{1}{2}$ in. opening.

1657. Transparent funnel, half-pint size. Overall diameter 4 in. by $4\frac{3}{4}$ in. long. $\frac{3}{8}$ in. opening

1658. Transparent gill-size funnel. Overall diameter $2\frac{3}{4}$ in. by $2\frac{7}{8}$ in. long. $\frac{3}{16}$ in. opening

1659. Transparent measuring cup. Holds 16 oz. 6 in. long. Top overall diameter $3\frac{5}{8}$ in.

1660. A transparent measuring cup. Holds 8 oz. $3\frac{1}{2}$ in. long. Top overall diameter $3\frac{7}{16}$ in.

1661. Round serving tray. $11\frac{1}{4}$ in. in diameter, brown, black, mottled red

1662. Push plate for doors. 12 in. long by 3 in. wide.

1663. 100 interlocking poker chips in molded box. Chips available in red, white and blue; boxes in red, brown, black, mottled effect

1664. Set of assorted, colorful leaf coasters with matching stand

1665. Jigger set; two-tone model $2\frac{1}{2}$ in. high; solid color, 2 in. high

1666. Toothbrush container. $6\frac{3}{4}$ in. long by $\frac{7}{8}$ in. wide by $\frac{5}{8}$ in. high

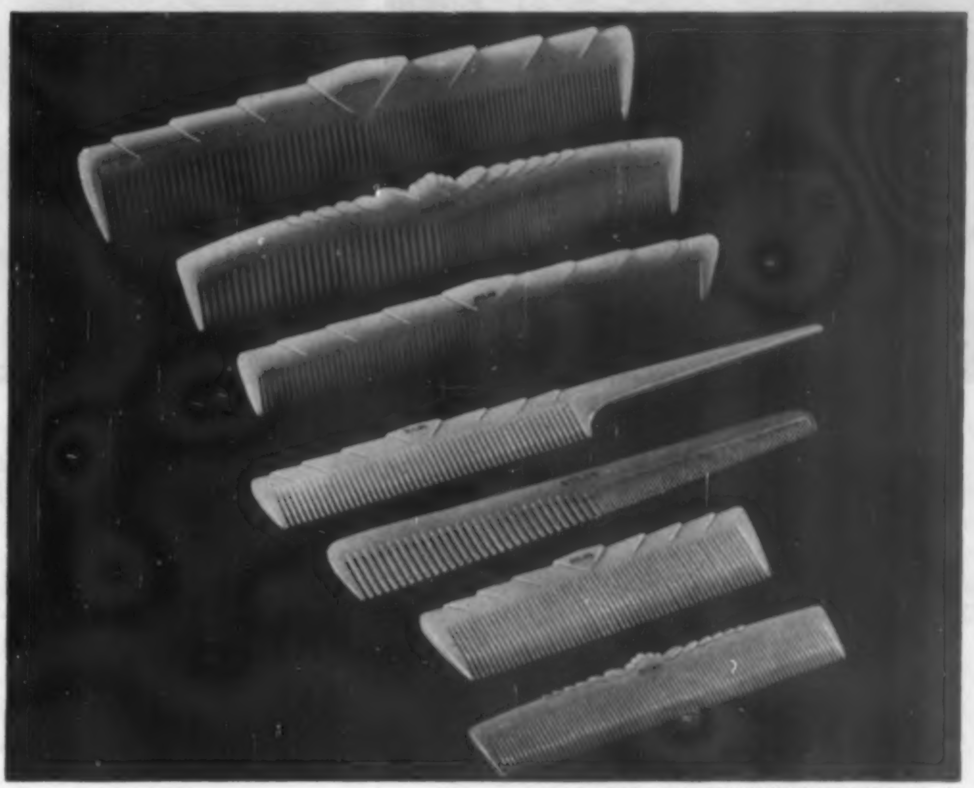
1667. Ash tray. $5\frac{1}{8}$ in. in diameter at base by 1 in. deep. Available in black, brown, and mottled red

1668. Two-piece ribbed soap box. $3\frac{1}{2}$ in. long by $1\frac{1}{4}$ in. deep

* Reg. U. S. Patent Office

Items 1–1582, which have appeared previously, are correlated in the Plastics Stock Mold Catalog ($5.00).

Molders and fabricators are invited to submit samples of stock products to appear on these pages as space permits



FIGS. 1-4, COURTESY COLUMBIA PROTECTOSITE CO., INC.

1—Exhaustive comparative tests have proven that nylon is an excellent material for combs, being tough and capable of being sterilized. After boiling for as long as 30 min., the combs were not bent, shrunk or curled at all

The injection molding of nylon

by DR. RUSSELL B. AKIN†

FOR nearly ten years, nylons have been known in the form of filaments for bristling and for textile applications. It was not until 1940, however, that custom molders received samples of nylons of the types that are offered for molding—the word *molding* being used here in the sense that the plastics industry uses it. While some nylon was employed during the war years for the molding of restricted military items, the full impact of nylon on molded plastics came in 1945.

It should be borne in mind that nylon is a generic term applied to polyamides made from a wide variety of raw materials. Those used for injection molding are different from those used for extrusion; and still other types are employed in the manufacture of filaments. The first nylon offered for injection molding bore the designation FM-1, and was offered in 1941 by the Plastics Dept. of E. I. du Pont de Nemours & Co., Inc. This is still the type in greatest production for use as a plastic, and is the standard injection molding composition of the nylon family. This article deals only with this one type of nylon.

Nylon in the solid form is a truly crystalline material, as demonstrated by X-ray studies. As a true crystalline material, it has a relatively sharp melting point and, above that melting point, about the fluidity of a light lubricating oil. The sharpness of the melting point means that there is no intermediate viscous stage which will permit the homogenizing of the molding composition by the mixing action of an injection piston and cylinder. Further, the material will not issue from the nozzle until material temperature is above 505° F. These characteristics made it necessary for nylon to be

* Reg. U. S. Patent Office.
† Technical service engineer, E. I. du Pont de Nemours & Co., Inc.

2, 3—Molded nylon is an apt choice for kitchen and bathroom articles such as these dishes, tumblers, babies' forks and spoons and traveling soap cases because it is resistant to breakage and can withstand boiling water

treated somewhat differently from other thermoplastic molding materials.

A test program to aid molders

Before FM-1 nylon was offered to custom molders, an extensive development program was undertaken at Arlington. In the latter stages of that program, many molds were evaluated to ensure that recommendations, which were set up on the basis of the results obtained from physical test specimens, could be employed satisfactorily for the wide variety of articles which custom molders are called upon to produce.

To date, approximately 1500 injection molds have been used in an 8-oz. Watson-Stillman machine fitted up with the minor modification which du Pont considers essential for molding FM-1 nylon. Although these molds had been designed for cellulose esters, acrylic resins or styrene derivatives, in all but half a dozen cases it was possible to use them, with little or no change in the cavities, for the molding of nylon at commercially practicable cycles. Where changes were required, they involved simply provision for heating the mold cavity or for enlarging the runners so that the nylon might enter the cavity speedily enough to prevent premature solidification.

As a result of the experience developed over a number of years, some rather fixed recommendations have been set forth. This article will deal with some of these and will comment on the experience of the Columbia Protektosite Co., Inc., who uses perhaps the most nylon.

FM-1 nylon is a thermoplastic molding material in the sense that it can be softened by heating, be made rigid by cooling and be resoftened by reheating. Nylon is not thermoplastic in the sense of becoming progressively more fluid as the temperature is raised. Once the material becomes hot enough to flow, it is so fluid that it will readily escape from the clearances customary in compression mold design. Nylon is thermally quite stable but, being an organic material, it is susceptible to oxidation at the high temperatures (about 520° F.) to which it must be heated in order to make it flow.

Injection molding recommended

This means that if FM-1 nylon is charged into a compression mold or a transfer pot, the nylon at the outside of the cavity must be overheated in order to supply enough heat to the innermost granules to permit the whole mass to flow. This overheating will produce articles which are badly discolored as well as very brittle. For these reasons, it is recommended that FM-1 and FM-3 nylons be handled only by the injection molding method.

In early attempts to inject FM-1 nylon the extreme fluidity of the material gave some trouble because of its tendency to ooze from the nozzle, the simplest expedient, cut-off nozzles, proving most effective. A variety of nozzles of this type were described in MODERN PLASTICS in November 1943, page 115.

The cut-off nozzle recommended for use with nylon is simply a stack of stainless steel screens mounted in the nozzle in such a way as to provide a restriction to the flow of molten material, yet permit easy passage of the nylon from the cylinder into the cavity when piston pressure is applied to the fluid material. This machine change is minor and can be made without rendering the cylinders useless for the molding of other thermoplastic powders. It is generally recommended, however, that a separate cylinder be used for nylon to avoid difficulties of "cleaning out" in transferring to or from nylon.

Table I.—Typical Injection Molding Conditions for Nylon

Item	*Maximum thickness of article*	*Cylinder temp.*	*Mold temp.*	*Overall cycle*	*Dwell (piston forward)*	*Diameter of nozzle*	*Location of gate*
	in.	*° F.*	*° F.*	*sec.*	*sec.*	*in.*	
Rod	1/2 dia., 12 long	500	200	150	60	1/4	3/8 in. dia. on end of piece
Tumbler	0.075	520	200	30	15	1/4	center
Coil form	0.020	520	200	15	7.5	3/16	end
Coil form	0.100	525	200	75	35	1/4	end
Plate 4 × 10 in.	0.250	525	250	105	60	1/4	end
Plate 4 × 10 in.	0.125	525	200	90	30	1/4	end
Plate 4 × 10 in.	0.060	530	200	90	30	1/4	end
Disk 12 in. dia.	0.125	520	200	120	60	1/4	center
Disk 6 in. dia.	0.375	520	250	180	60	1/4	center

In adapting the machine to the molding of nylon, a cylindrical cage is put into the nozzle at such a point that the tip or downstream end of the torpedo must be cut off. For a 6-oz. injection cylinder, this cage is about 1 1/4 in. deep and 1 1/4 in. in diameter. On the downstream end, the cage has a breaker plate and against that plate are set alternate layers of 100- and 50-mesh stainless steel screen to a depth of about 3/4 inch. These are followed by another breaker plate which has about 1/8-in. between it and the shortened torpedo tip.

The number of screens may vary from 10 to 20, alternate layers of 80- and 40-mesh screen may be used. The screen pack will not only reduce oozing between shots, which wastes material and prevents good seating of the nozzle against the die bushing, but will increase the strength of the molded piece by ensuring that only thoroughly fused nylon enters the mold.

Nylon is not corrosive to metal, nor is itself damaged by clean steel surfaces. Thus it is not necessary, nor advisable, to use other than a good tool steel for the construction of the cylinder and a nitralloy piston. The cylinder must be capable of being heated to temperatures which may range as high as 540° F. This precludes the use of oil, and electric resistance heater bands are recommended, with individual controls for each band.

The piston should have a small clearance—0.002 to 0.003 in. per in. of diameter—and, preferably, should be water-cooled. In some instances, particularly with thick sections, the piston is held in the forward position for 50 to 70 percent of the molding cycle. Because of the high temperatures at the base of the cylinder, this long dwell may overheat the piston. If the piston is not slightly cooled, it becomes hot. Then, if the piston has an appreciable clearance, the nylon may work back over the end, to form a ring or rind similar to a cup packing. This ring of nylon may, particularly if the piston is slightly off center, force the piston to one side and cause scoring of either piston or cylinder wall.

A guide to molding conditions

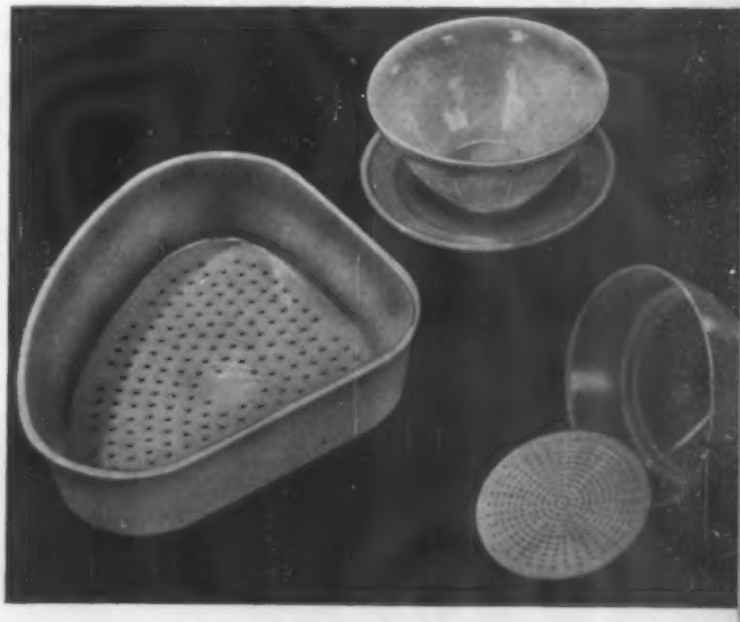
As every molder realizes, exact conditions as to temperature, pressure and cycle can be set up only on the basis of actual trial. The following are, however, recommendations based upon work with a large variety of molded shapes:

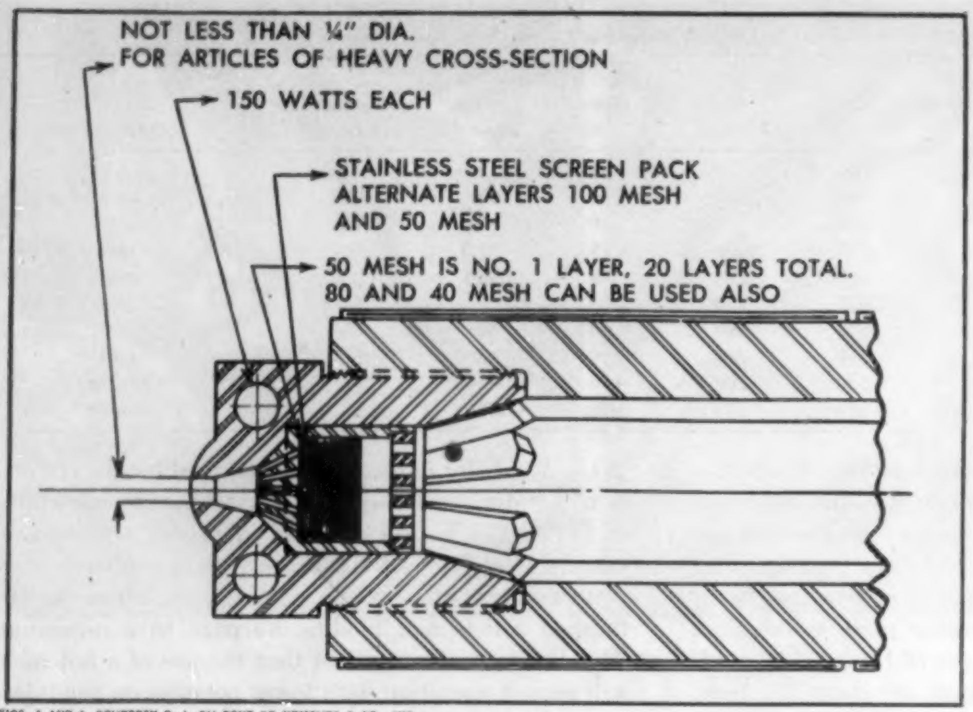
1. Molds for nylon should be drilled for the circulation of water and be operated normally at temperatures of 170 to 270 F. This heated mold will prevent premature solidifying of the nylon, thus permitting complete filling of the cavities, giving a high gloss to the finished article and holding warpage to a minimum. This last is due to the fact that the use of a hot mold will permit operation with lower pressure on the injection cylinder, and thus cause less development of strain in the articles. Although high mold temperatures are used as compared with those used in molding cellulose esters, the higher setting temperature of nylon of this type will permit cycles, at mold temperatures above 200° F., which are approximately as short as those required by a moderately fast-setting cellulose acetate.

2. Nozzles for most articles which would be made in a 6-oz. or larger machine should never be less than 1/4 in. in diameter. Larger diameters and higher mold temperatures will increase the rate of filling of the mold.

3. Nozzle temperature may best be the same as that of downstream end of the cylinder. Or it can be slightly

4—Much-needed accessories for the kitchen are this heat-resistant funnel and strainer set, bowl, saucer and sink strainer—all articles injection molded of nylon material





5—The proper assembly of the nozzle, cage and cylinder of the injection machine, shown in the drawing, is an important factor in the molding of nylon. Screens prevent oozing of molten nylon from nozzle

FIGS. 5 AND 6, COURTESY E. I. DU PONT DE NEMOURS & CO., INC.

higher or slightly lower. Control of nozzle temperature should be independent of that of the barrel temperature. For a 6- to 12-oz. cylinder, it is recommended that the nozzle be drilled crosswise to permit the insertion of four heater cartridges, each of 150 watts or more. Such a nozzle is illustrated in Fig. 5.

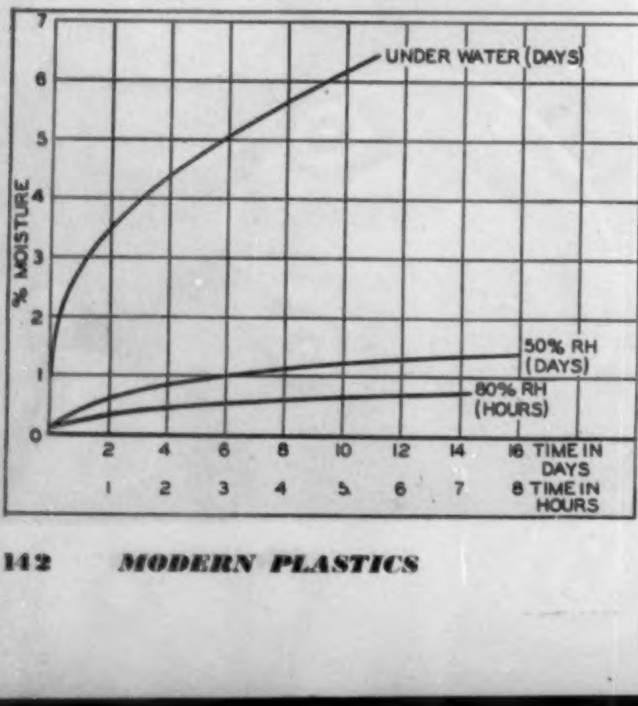
4. Optimum temperature of cylinder will vary with the type of cylinder, the number of screens employed and the amount of material per shot. Generally it is advisable to use a thermocouple directly in the stream of molten nylon. When this is difficult to arrange mechanically, a valuable indication of proper molding temperature is the ability of the material to be ejected from the cylinder so that it flows about like warm honey. The material should remain completely transparent for several seconds after issuing from the nozzle. This usually requires that heater band temperatures be slightly above 520° F.

5. Injection pressure, with a clean nozzle and clean screens, and with nozzle, sprue and gates of adequate size, will range between 6000 and 18,000 p.s.i. Smaller gates will necessitate injection pressures up to 25,000 p.s.i., which may cause added difficulty due to flash. If high material pressures are required to inject with new screens, and the molded pieces show "mica" or "splay marks," resulting from the excessive temperatures required, then some of the screens should be removed. If the cylinder has been used for some time, and the pressure and temperature have constantly to be increased to produce full pieces free of "mica" marks, it is an indication that the screen pack is fouled or should be replaced with clean screens.

6. Charging of the cylinder should be done with gage pressure reduced below 400 pounds. Sufficient time should be allowed to soften unmelted particles at the front of the cylinder. Not until the nylon can be flowed from the nozzle like honey should the injection pressure be raised to that required for filling of the cavity. These precautions are to prevent application of high piston pressure while unmolten granules are present, an action that would cause deflection of piston, with scoring of cylinder or plugging of screen pack.

7. Removal of the nozzles from the cylinder is best done by giving the nozzle one turn while it is still hot and then unscrewing slowly over the next few minutes as the nylon solidifies and the metal cools. Under no circumstances should an attempt be made to remove the nozzle while fluid nylon is still in the cylinder. If the nylon in the nozzle freezes before removal of the nozzle, the nozzle and end of cylinder should be reheated and the above procedure repeated.

6—This graph illustrates the rate of pickup of moisture by nylon molding powder at various relative humidities



8. When another material is to be used in a cylinder which has been used with FM-1 nylon molding powder, it is best done by maintaining the cylinder at the temperature required for the nylon. The desired type of molding powder is then fed into the material cylinder and injected through the screen pack and nozzle to remove traces of nylon. Usually it is preferable to scavenge nylon with a hard composition of the same material that is to be used for subsequent molding, even though a soft composition may ultimately be used. For 6-oz. cylinder, from 5 to 10 lb. of either powder may be required for scavenging. However, it is not only good practice, but in the long run simple economy, to use a separate cylinder for each type of molding composition.

9. Precautions to be taken in the molding of nylon are those involved in avoiding the risk of burning the operator. Nylon is so fluid that if the mold is not closed tightly, or the nozzle does not fit into the mold securely, there may be a dangerous spurt of molten nylon. Under no circumstances should operators stand at the parting line of a mold unless a barrier is interposed. Once a cycle is established, no precautions are required beyond those used for other injection materials. It is, however, advisable that the operator use a face shield and gauntlets when a machine is started up or when a new mold is being started.

The molding cycle for nylon is determined largely by the thickness of the section and the diameter and length of sprues. In going from the liquid to the solid crystalline state, FM-1 nylon contracts 16 percent in volume. This means that piston pressure must be applied to fluid material through nozzle and sprue as the nylon sets up, to ensure that additional material is provided to compensate for this shrinkage. Therefore, general practice provides a time of dwell with piston forward amounting to upwards of one-half of the whole cycle. This does not mean that a molding cycle is longer than for other thermoplastics for the longer time of dwell is balanced by the greater speed with which nylon may first be injected. Table I shows the cycles found best for many shapes. The use of a shorter dwell, a colder die or too slow travel of the piston will produce molded pieces with tiny bubbles in their centers. This is particularly true with sections thicker than $^1/_4$ inch.

Nylon will flow readily into thin sections, but if a moderately thick piece is to be molded, the gate into that section may have to be enlarged to provide for maintenance of fluid pressure on the piece during the dwell portion of the cycle. This may mean that runners satisfactory for other plastics will have to be enlarged somewhat for nylon. Raising mold temperatures from 100 to 200° F. will do a great deal to reduce the need for enlarging gates and runners. The toughness of a nylon gate is such that it must usually be cut off rather than snapped off, and trimming plans will usually be very important in determining what procedure to apply.

10. Nylon molding power is packaged in moistureproof drums, suitable for molding when received. Since it has been vacuum-dried to less than $^1/_4$ of one percent of moisture content before it is packaged, no further drying of the powder is necessary if proper precautions are observed in using it after opening.

Moisture content and its control

Nylon molding powder will pick up moisture readily. Figure 6 shows the rate of pickup of moisture at various relative humidities. Two hours' exposure to room atmosphere results in the absorption of sufficient moisture to impair the quality of the molded articles. The moisture content of the nylon powder should not be allowed to go more than slightly above 0.25 percent.

If nylon molding powder contains moisture much in excess of 0.25 percent, the surfaces of the molded piece will be marred by scaly spots, mica marks or splashes. The appearance of the molded piece is important as such, but it is even more important as an indication of impact strength. Pieces marred by moisture marks are inferior in strength.

To keep the material dry, the drum should be kept closed, or else stored in an oven at 160° F. Keeping too much material in the hopper permits excessive absorption of moisture. It is recommended that only sufficient material be placed in the hopper for thirty minutes of normal operation, unless provision is made to cover hopper and hold its temperature at 160° F.

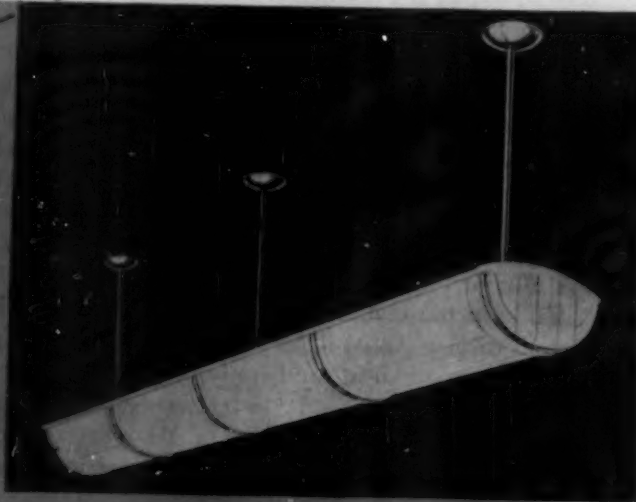
A word of caution is offered relative to methods of drying. Drying nylon powder in contact with air is undesirable because it materially impairs the ultimate strength of the molded article. The ordinary procedure of drying by infrared bulbs is not recommended for nylon because nylon holds water so tenaciously that temperatures above 225° F. are required to do an effective job of drying. Prolonged exposure of nylon to air at such temperatures will cause discoloration and some embrittlement. Emphatically, vacuum drying by the manufacturer of the material is to be preferred, and arrangements have been made by the manufacturer to recut and dry the scrap from molding operations.

FM-1 nylon scrap may be reused by blending with dry virgin material in amounts up to 50 percent. *The scrap must be free from carbonaceous particles and off-color moldings, and must be properly dried.* If these precautions are followed, the properties of the molded articles will be as good as those of articles molded from virgin material.

The scrap should be cut to a particle size of approximately $^1/_4$ in. and dried in vacuum (29 inches) for 4 hr. at 100° C. (212° F.) or for 8 hr. at 85° C. (185° F.). Sprues and runners may be reused without drying only if they have been stored in moistureproof containers immediately after having been molded.

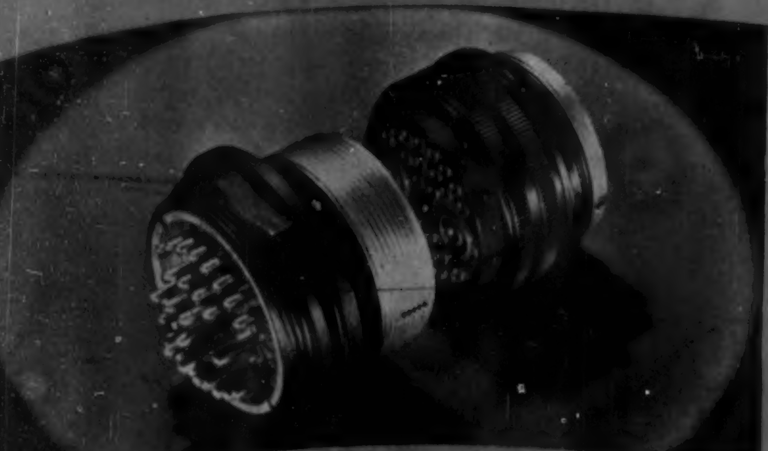
Vacuum shelf driers or vacuum rotary driers are recommended for drying the nylon scrap prior to molding. One-half a cubic foot of cut nylon scrap, or about 15 lb., can be dried as a 1-in. layer in 4 hr. in the model B-3 shelf drier manufactured by the Buffalo Foundry and Machine Company, or in driers of similar size made by F. J. Stokes Machine Company and Proctor and Schwartz, Incorporated.

Plaskon Materials



Newest type of fluorescent lighting fixture, made almost entirely of Plaskon urea-formaldehyde. F. W. Wakefield Brass Company, Vermilion, Ohio.

Telex Magnetic Pillow Speaker housing of Plaskon Molded Color. Designed for normal sound reproduction when placed under a pillow. Telex, Inc., St. Paul, Minn.



Pressurized connectors made of cellulose filled Plaskon melamine to extremely rigid specification because of its low moisture absorption, high volume and surface resistivity, very high arc resistance, excellent dielectric properties at low and high frequencies, impact resistance and resistance to heat. H. H. Buggie & Company, Toledo, Ohio.

Aircraft installations using Plaskon—(1) trim tab indicator actuator; (2) housing for map reading light; (3) core governor resistor and (4) block assembly governor terminal, both used with Beech-Roby propeller. Beech Aircraft Corp., Wichita, Kan.

Light weight fly rod, weighing only 2¼ ounces, made of Plaskon Resin and glass fibers. Extremely strong and supple. Shakespeare Company, Kalamazoo, Mich.

Small, inconspicuous Plaskon Molded Color hearing aid ear piece, which blends beautifully into the flesh tones of the wearer. Product of Zenith Radio Corporation, Chicago, Ill.

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Some of the recent revolutionary developments made possible with Plaskon Molding Compounds, Plaskon Resin Glues and Plaskon Specialty Resins are illustrated and described here.

These jobs are in commercial production, opening new market and sales opportunities to industry. Here are the Plaskon Materials and their distinctive features:

PLASKON UREA-FORMALDEHYDE MOLDING COMPOUND

1. Wide range of lightfast hues, from translucent natural and pure white to jet black.
2. Smooth surface, eye-catching, warm to touch.
3. Completely resistant to common organic solvents, impervious to oils and grease.
4. Possesses high flexural, impact and tensile strength.
5. Highly resistant to arcing and tracking under high voltages and high frequencies.

PLASKON MELAMINE MOLDING COMPOUND

1. Assures ample protection where water or high humidity prevent the use of urea compounds.
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3. Under extreme conditions of heat and humidity, is non-tracking, highly resistant to arcing, and has high dielectric strength.

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Hot- and cold-setting resin glues to meet a wide range of requirements in the veneering, laminating and bonding of woods. The resin glue line, being infusible and insoluble, is permanent proof against extremes of temperature, gasoline, oil and common solvents.

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PLASKON SPECIALTY RESINS

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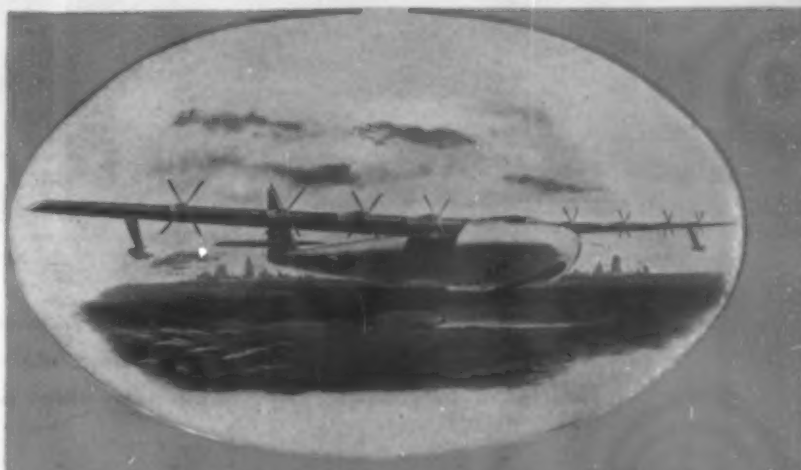
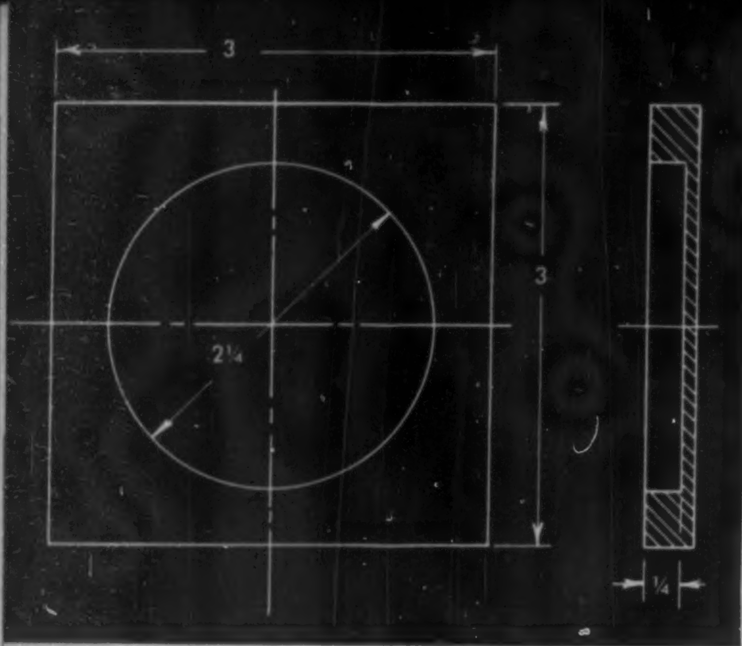


The new Hughes H-4, world's largest plane, made almost entirely of woud. Enormous quantities of Plaskon Resin Gluc were used for this job.

A newly-developed, low pressure laminating resin has made possible this revolutionary plastic engineering material: a sandwich of parallel laminates of Plaskon resin and glass cloth, separated by and bonded to a featherweight "honeycon.b" core made of the same resin reinforced by glass cloth.

The patented cell-type Rezo Door made with Plaskon Resin Glue by the Paine Lumber Company, Ltd., Oshkosh, Wisconsin.



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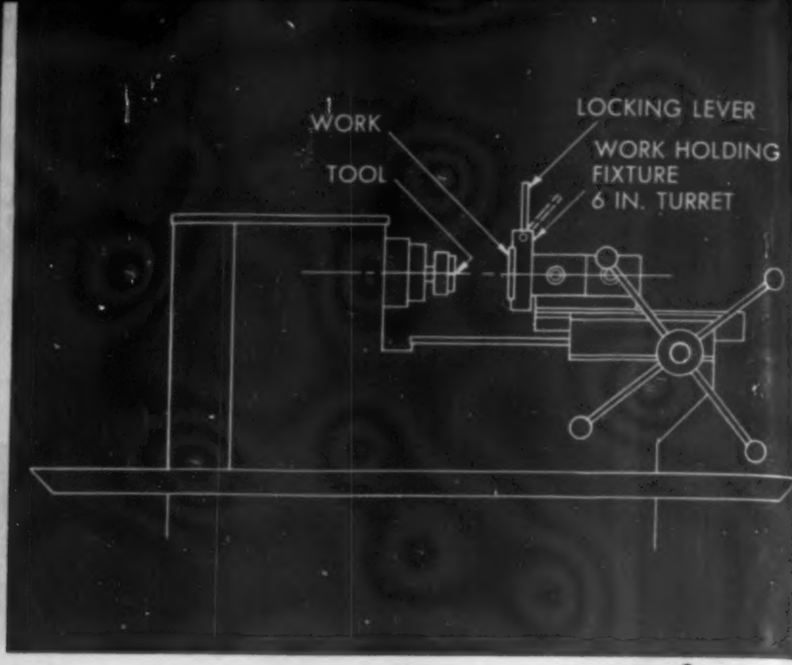


2

1—Turret lathe was used to machine the $2^1/_4$-in. blind hole in this piece of acrylic. 2—To speed production by cutting machine loading time, the usual position of tool and work piece was reversed—the tool rotates in the spindle while work is held in cam-operated turret fixtures

Fabricating with metal working machines

by GEORGE BECKER*

THE manufacturer of metal goods who wishes to increase his production output without a proportionate rise in labor cost can usually do so by investing in expensive but more economical machinery. But the plastic fabricator who has the similar idea finds very little, if any, equipment ready-made on the market to suit his purposes. However, he has one way out and that is to select existing metal working equipment and adapt it for the particular requirements of plastic fabrication.

When selecting metal working machinery for conversion into machinery for the fabricating of plastics, two factors must be given special consideration: 1) Cutting speeds on plastics are considerably higher and feeds faster than on metals. 2) The ratio between productive machine time and machine loading time (down time) is generally much smaller for plastic materials than for metals.

Because of this, only high-speed equipment permitting very fast loading and unloading of work-holding devices should be chosen. If both or either of these two main features cannot be found on available equipment, then easy and economical conversion should be the prime factor.

Two examples of how basic metal working machines—a turret lathe and a milling machine—have been successfully converted into high production tools for machining of plastic materials will be explained here.

* Elar Plastics Corp.

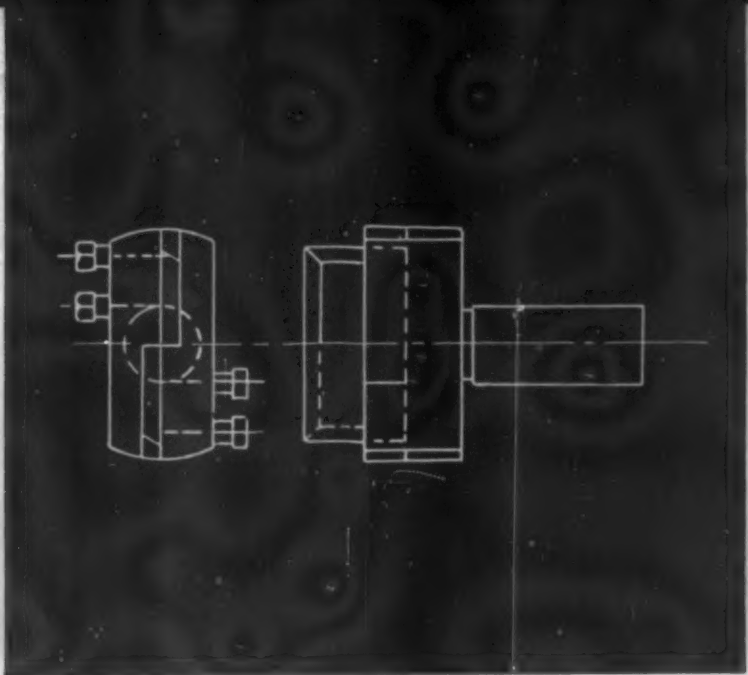
A converted turret lathe

A turret lathe was used to machine the $2^1/_4$-in. blind hole in the work piece shown in Fig. 1. Cast methyl methacrylate material was employed. The turret lathe, a No. 2 Morey, proved particularly adaptable. Its spindle speed goes up to 2000 r.p.m.

To cut machine loading time to the minimum, the usual position of tool and work piece was reversed. The tool was held and rotated in the spindle and the work pieces were held in cam-operated fixtures on the turret. Figure 2 shows this set-up diagrammatically.

Actual machine time per piece was less than six seconds. To accomplish this, the turret was provided with six work-holding fixtures so the operator of the machine could unload the finished part from a fixture and reload another part to be cut while the cutting was in process. Therefore, considerable time taken up loading and unloading the machine was saved. The only machinery time lost was that taken to index the turret and bring the work piece up against the cutting tool. Naturally it was not necessary to stop the spindle between the machining of two pieces as would have been the case if square pieces were held in the conventional way in a revolving spindle chuck.

A two-lipped end mill type tool, made up from a standard tool holder into which two carbide tipped blades



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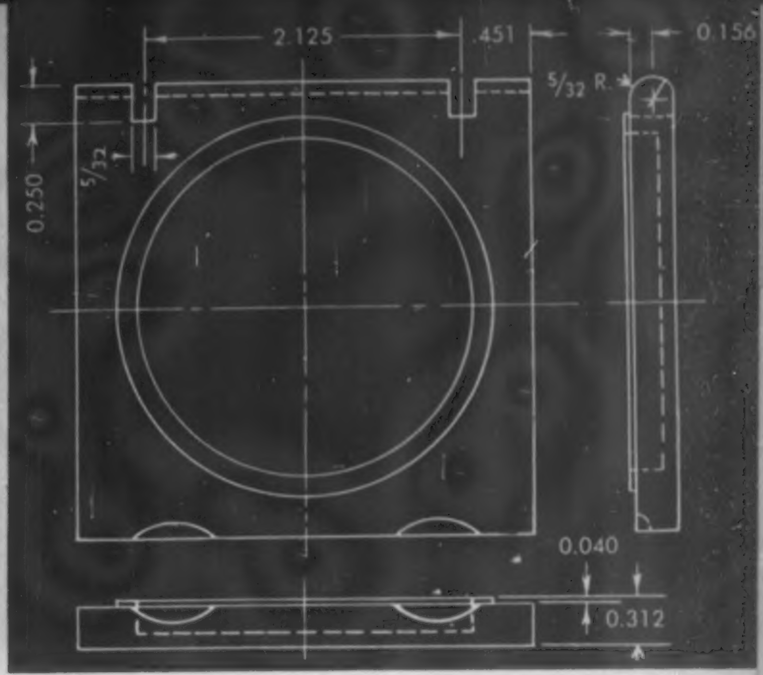

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3—A 2-lipped, end mill type tool, made from standard tool holder into which 2 carbide-tipped blades were inserted, was used in a turret lathe (Fig. 2) to cut $2^1/_4$-in. blind hole in acrylic. 4—Another time, to speed machining of $2^5/_{32}$-in. wide slots, 2 high-speed side milling cutters replaced a router

were inserted, was used (Fig. 3). To secure a perfectly balanced cut, the blades were ground to proper dimensions after insertion into the holder.

The high production rate of this set-up requires a powerful exhaust system to remove chips and fumes rapidly. Compared to other methods the output per operator was three to four times higher.

A side milling cutter

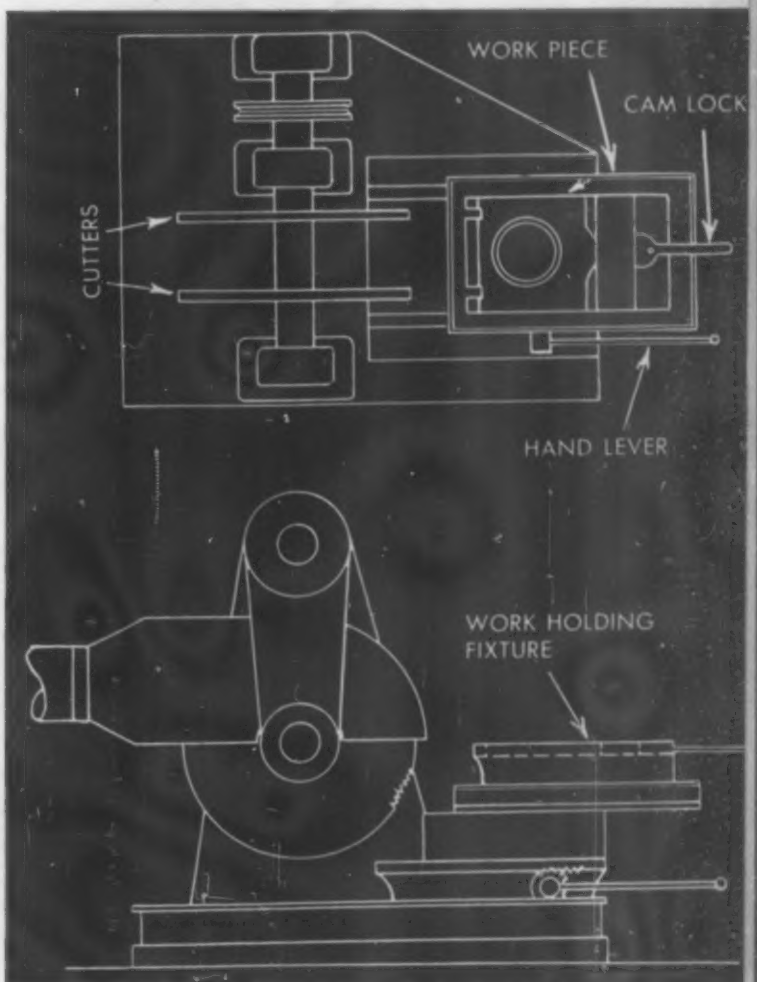
In another case the job was machining of the two $^5/_{32}$-in. wide slots into the piece shown in Fig. 4.

The operation was originally done on a router where the work pieces were fed by hand against a $^5/_{32}$-in. diameter router bit. Guides fastened to the surface of the router table spaced the slots properly, but this method proved too slow and inaccurate to meet output requirements. Therefore slots were cut on a high-speed production milling machine.

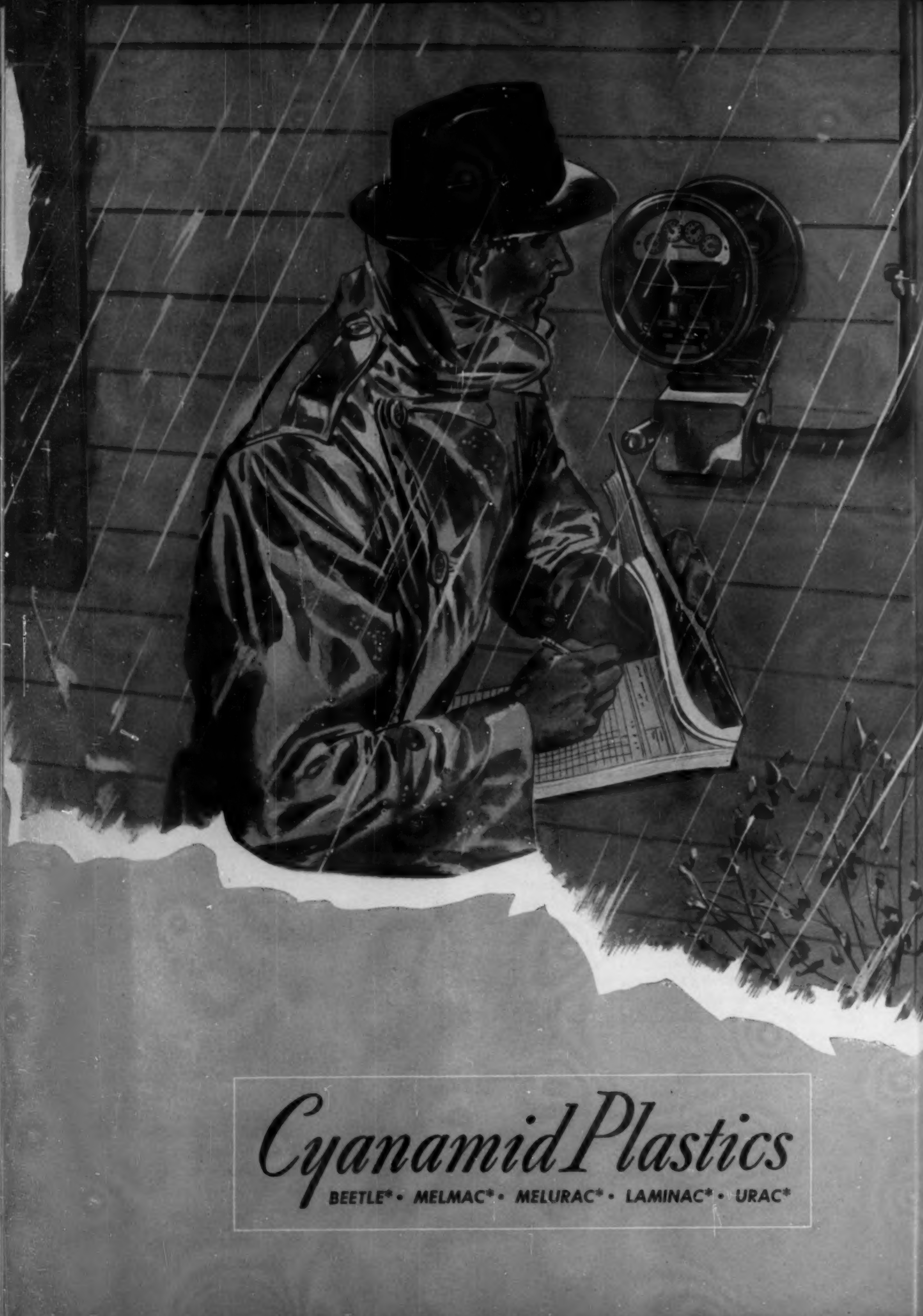
Two high-speed side milling cutters $^5/_{32}$ by 5 in., run at 2000 r.p.m., were used. A cutting speed of about 3000 ft. per minute resulted. The milling machine was a small toolroom miller which was converted by removing the spindle gears and driving the spindle directly from the motor and by replacing the table feed screw with a pinion rack feed. Work pieces were held in a simple, quick action type, milling fixture as shown in Fig. 5.

A work piece was loaded into milling fixture recess and held in place with a lever-operated cam-action clamp. Chips and fumes were removed by an exhaust pipe connected to a hood fitted over the cutters.

The output of three milling machines set up in this manner averaged 12,000 to 15,000 pieces per 8-hr. shift with work quality greatly improved. Cutters stood up 150,000 pieces without resharpening. One $^1/_4$-in. concave radius cutter made over 200,000 3-in. cuts.



5—To cut slots shown in Fig. 4, work is loaded into fixture recess, secured with cam-action clamp. With this set-up, 3 millers averaged 12,000 pieces per 8-hr. shift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Extensive tests were made to find a general-purpose plastic that could be easily molded, and which possessed the right combination of mechanical strength and resistance to arcs or arc tracking. The plastic material formerly used when exposed to an ASTM arc-resistance test showed the formation of a conducting carbon path when exposed to arcing for only 5 or 10 seconds.

Tests of MELMAC plastic made in accordance with ASTM standards showed an arc resistance in excess of 120 seconds. Cyanamid's wood-flour-filled MELMAC plastic 1500 not only resisted the carbonization caused by arc-over but freed itself of any foreign matter without leaving any conducting path across the material. The results of these tests demonstrated to Sangamo Electric Company that the use of MELMAC plastic would practically eliminate any terminal block failures resulting from high-voltage surges or arcs.

Cyanamid's MELMAC plastic 1500 has found many other applications in electric equipment where arc-resistance is of utmost importance. Its use in circuit breakers, switch plates, connector plugs, terminal blocks, motor-brush stud and insulating parts provides longer life and added safety.

If you want longer life for the plastic in your electrical products—write or call the Plastics Division, American Cyanamid Company.

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*Reg. U. S. Pat. Off.

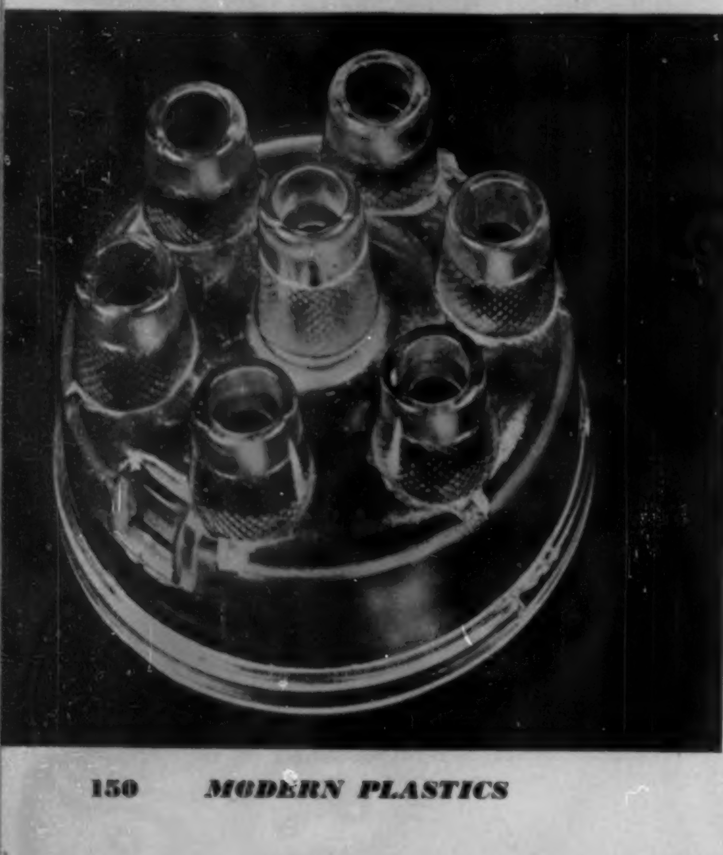
Curved, complex wooden shapes such as the ribs in this wooden boat hull can be easily joined with Cyanamid's low-pressure-setting URAC* resin 185 adhesive. For wooden assemblies, sporting goods manufacture, furniture making, and cabinet work where it may be difficult to apply sufficient pressure to obtain a uniformly thin glue line, URAC 185 forms a craze-resistant, durable bond in thicknesses up to .020 inches.

BEETLE* plastic is a combination of the practical and the ideal for such packaging purposes as this Cutex manicure kit. A wide variety of colors provides a range of choices, increases attention value, multiplies sales at no additional expense. Chemically inert, dimensionally stable, resistant to impact, wear, and abrasion, BEETLE meets all requirements for service as well as sales.

Zinc alloy molds for short runs

PHOTOS, COURTESY ENGINEER BOARD, FT BELVOIR, VA.

1



2

How to produce economically, without elaborate equipment or expensive molds, transparent acrylic models of mechanical parts that could be used by the Army for training purposes?

THIS was the problem that faced the Engineer Board Model Shop, Fort Belvoir, Va.—a shop that was engaged for some time in making training aids, and instructional models for the Army. For the answer, S. B. Swenson, a civilian, and Sgt. Chas. McWhorter were put in charge of an extensive research program on methods of molding plastics.

Since the work did not warrant the expense of elaborate equipment, the search was for a process which would operate with the material on hand. Due to the intricate shape of the castings and the pressures required to clarify the plastic mix the plaster molds, which were tried out first, proved unsuccessful. The next attempt was made with lead molds. The castings were full of defects and pressure distorted the mold.

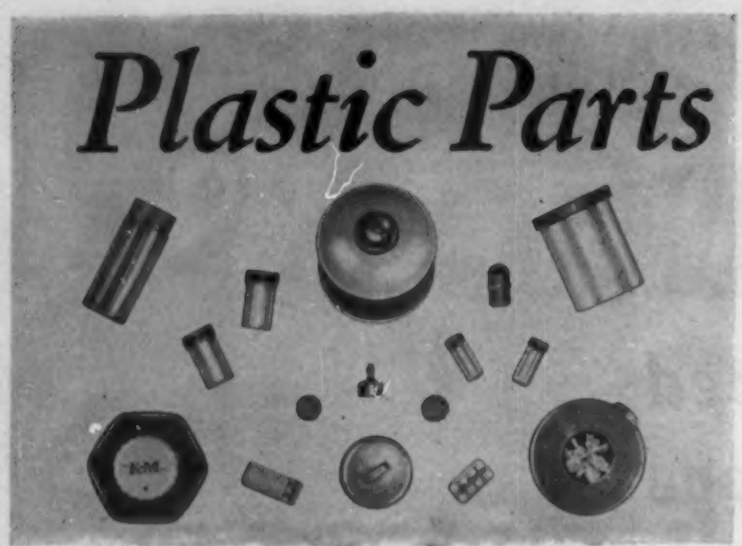
One thing, however, was learned from these experiments—that the greater the pressure exerted upon the molding material, the better the chances for a good casting. Conventional methods of die making were much too costly for such short run production as contemplated for these training aids, yet zinc alloys strong enough to withstand the required pressures had too high a melting point to be made in the same manner as the plaster molds. Finally, a process was evolved whereby the original pattern was faithfully reproduced in a zinc alloy mold capable of standing molding pressure.

The material used for the transparent models was a methyl methacrylate monomer and polymer mixture introduced into the mold in a manner to preclude the possibility of any air being trapped in the material. The pressures varied from 1000 to 2000 p.s.i., depending on the intricacy of the molded part. The temperatures and time cycles for curing the material in the mold depended, in turn, upon the pressure employed.

The number of reject castings in this type of mold is surprisingly small. If the mold is properly polished, the castings as removed from the mold have a luster comparable to the finest buffing.

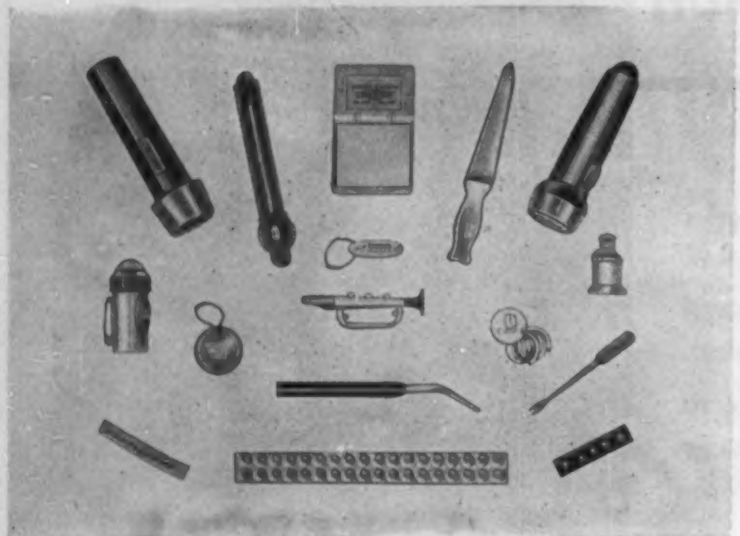
Beginning with the original order of ten carburetors, the Engineer Board Model Shop has built up a plastics department which is busily turning out all kinds of plastic training aids such as starting motors, fuel pumps, distributor caps, evaporators and expansion valves.

1—To produce small quantities of clear models, like this molded acrylic carburetor, at low cost and with equipment available in the Army's model shop, a new process for zinc alloy molds was evolved. 2—All types of training aids similar to this distributor cap have been made

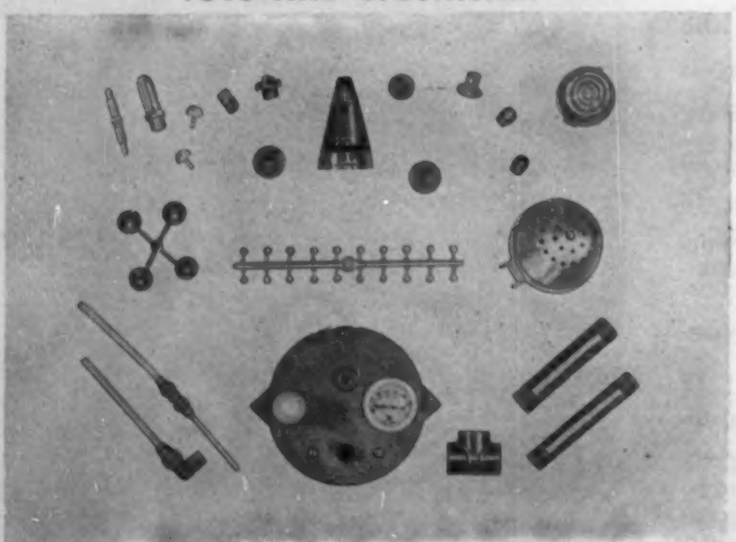


OF EVERY DESCRIPTION

CONTAINERS AND CLOSURES



TOYS AND SPECIALTIES



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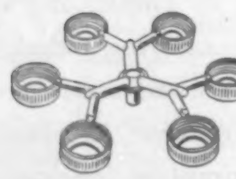

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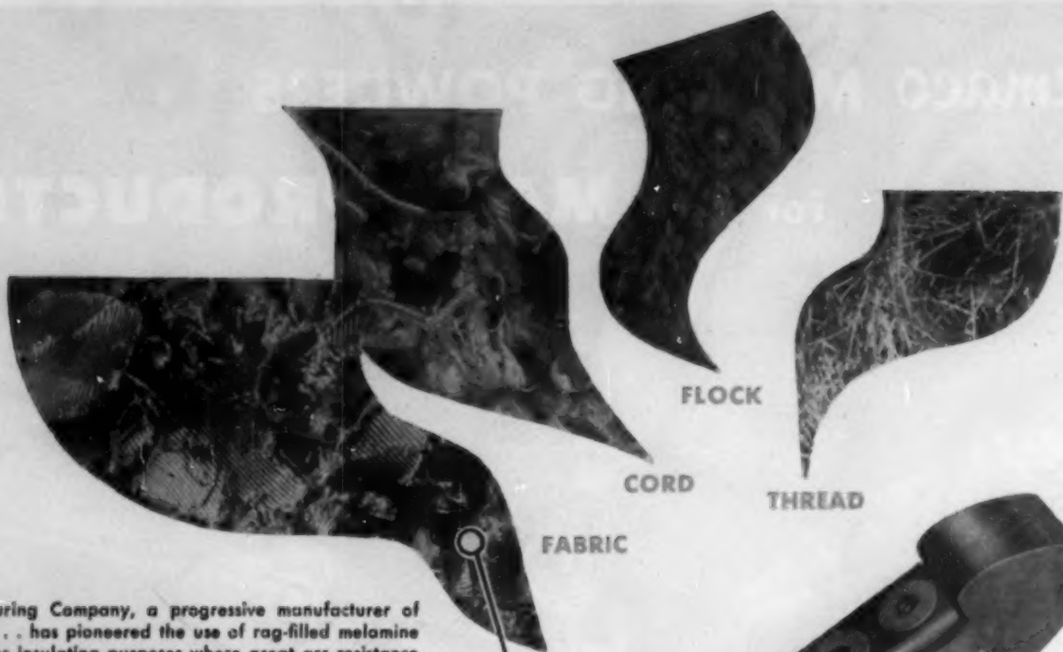
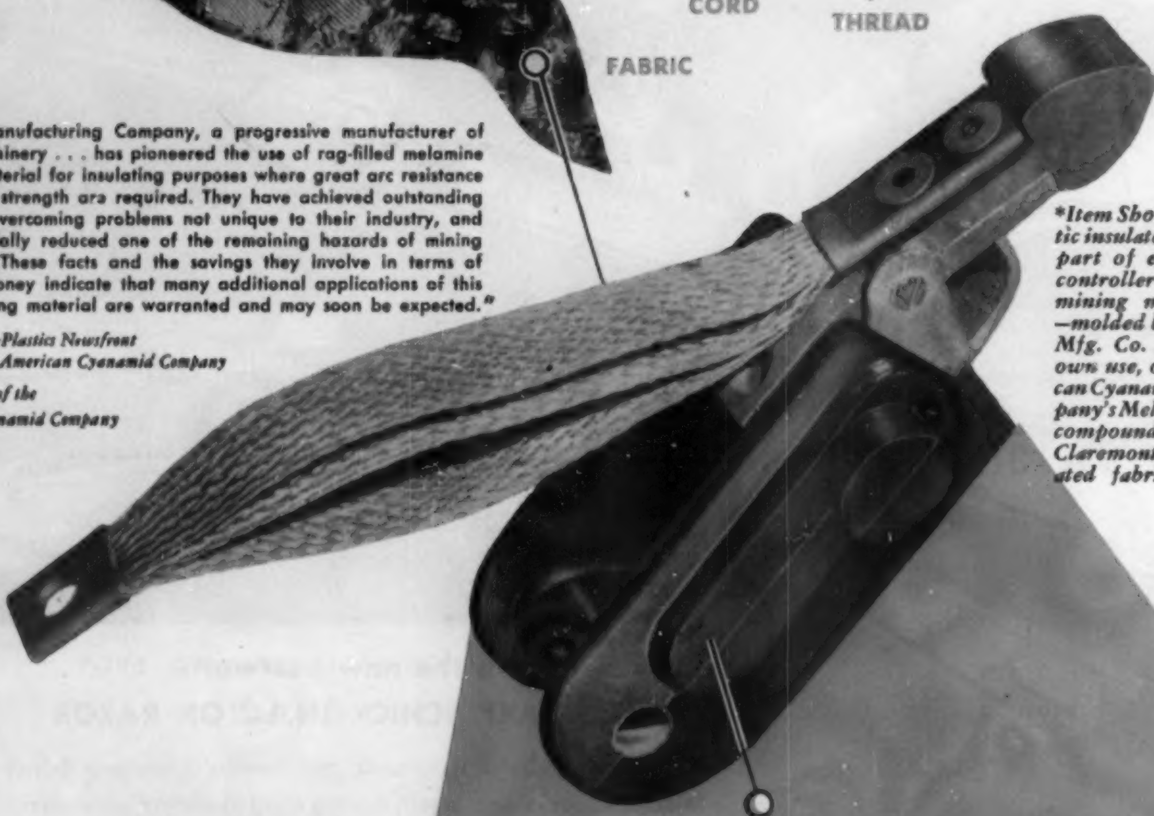


"The Joy Manufacturing Company, a progressive manufacturer of mining machinery . . . has pioneered the use of rag-filled melamine molding material for insulating purposes where great arc resistance and impact strength are required. They have achieved outstanding success in overcoming problems not unique to their industry, and have materially reduced one of the remaining hazards of mining operations. These facts and the savings they involve in terms of time and money indicate that many additional applications of this new insulating material are warranted and may soon be expected."

Excerpt from—Plastics Newsfront
Published by *American Cyanamid Company*

Photo courtesy of the American Cyanamid Company



**Item Shown—Plastic insulated contact part of electrical controller used in mining machinery—molded by the Joy Mfg. Co. for their own use, of American Cyanamid Company's Melmac 3020 compounded with Claremont macerated fabric fillers.*

The Use of *Uniform* Claremont Cotton Fillers in Your Plastic Formulations Insures *Easier* Processing, Greater Strength, *Better* Products!

We of Claremont Waste Manufacturing Company, are very grateful to American Cyanamid Company's fact-finders. By their gracious co-operation, we are enabled, from time to time, to point out the service satisfaction being rendered industry thru the supporting use in plastics formulations of Claremont Fillers.

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The Country's Largest Manufacturers of Flock

CLAREMONT WASTE MANUFACTURING CO.
CLAREMONT, NEW HAMPSHIRE

German manufacture of phenolic resins for molding and laminating*[1]

This article is based on the production manual of Dynamit A.-G., Troisdorf. The translation was prepared by Dr. G. M. Kline and Mrs. I. G. Callomon, National Bureau of Standards. The information in the report was obtained in a three months' investigation of the important plastics plants in Germany made by the senior translator under the auspices of the Office of the Chief of Ordnance, War Department.

THE Dynamit A.-G. is a subsidiary of I. G. Farbenindustrie A.-G. Plant at Troisdorf is the center of production of molding compounds and laminates for the I. G. firm. This report describes the preparation of the phenolic resins and varnishes for these products. The monthly production of phenolic resins was 500 tons (dry basis), of which 350 tons were used in the production of molding compounds and 150 tons for laminating. Later reports will cover the formulation and processing of the molding compounds and laminated sheets.

The composition and yield data for the various resins are presented in Table I. The viscosity grades produced in each type of resin and other properties of the finished resins are listed in Table II. Directions for the preparation of each resin are given in the following paragraphs.

Resin T1 (phenol resol in lump form)

The ammonia and magnesium oxide, previously mixed with water, are added to the solution of phenol and formaldehyde. The mixture is condensed for 2 hr. at 60° C. and subsequently vacuum distilled. As soon as the temperature has dropped to 50° C. the hexamethylenetetramine, mixed with water, is added. The dehydration is carried out at approximately 50° C. After the bulk of the water has been removed, the distillation is continued with increased vacuum to keep the temperature of the resin at all times from exceeding 70° C., until a sample has the required viscosity. Then the kettle is immediately emptied under pressure. This particular resin has a calculated nitrogen content of 2.3 percent.

Resin T3 (cresol resol in lump form)[2]

Cresol with a *m*-cresol content of 37–42 percent, varying in different lots, is mixed with cresol of lower *m*-cresol content (28–35 percent) and brought to a *m*-cresol content of 38 percent. The materials are added to the kettle in the following order: cresol, ammonia, formaldehyde. They are condensed for 105 min. at 85° C. or for 50 min. at 100° C. The water is then removed by vacuum distillation at a resin temperature of 45–50° C. and 50–60 mm. of mercury pressure.

As soon as the resin in the vessel has become clear and the temperature starts rising, the heat is gradually shut off and the temperature is allowed to rise to a maximum of 75° C. at 30 mm. of mercury pressure. The distillation is terminated as soon as the desired viscosity of the resin is reached. The viscosity is determined in a 1:1 acetone resin solution using an Ostwald viscosimeter.

The first viscosity determination is appropriately made at the time when the stirring apparatus has to be shut off because the resin melt is becoming too viscous. The viscosity increase is observed by repeated sampling in order to determine when to stop the distillation. The kettle is emptied—if necessary, under pressure—into pans, 38 by 76 by 7.5 cm., which must be placed immediately in cold running water to complete the cooling process.

Resin T3SM (formerly T3S)

Cresol DAB VI containing 50 percent *m*-cresol is used. The mixture of cresol, formaldehyde and ammonia is condensed for 80 min. at 80° C., then de-

* The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it but use of it by anyone must be and is at one's own risk in so far as the United States or foreign patent violations are concerned.

[1] For additional information on this subject, see MODERN PLASTICS 23, 152L (Oct. 1945).

[2] Resin T3F (see Table II) was used in the manufacture of Lignofol. It was erroneously reported in the March 1946 issue, page 156, that resin T3S was used for this purpose.

Table I.—Composition and Yield of I. G. Molding and Laminating Phenolic Resins

	Resin T1	*Resin T3*	*Resin T3SM*	*Resin T4*	*Resin T4N*	*Resin T5*	*Resin T21A*	*Resin T24E*	*Resin T43SM*	*Resin 221*	*Resin HLS*
COMPOSITION											
Phenol[a], kg.	1100	..	..	1300	1300	700	800	1300[b]	..	750	750
Cresol, kg.	..	1500	1200	..	..	..	..	..	..	..	..
Xylenol, kg.	..	..	..	..	..	..	..	..	1200	..	..
Formaldehyde (30%)											
Amount, kg.	1980	1350	960	1120–1220	1145–1220	700	1160	1080–1200	840	730	730
Mol ratio to phenol	1.7	0.97	0.96	0.81–0.885	0.825–0.885	0.94	1.36	0.83–0.92	0.8	0.91	0.91
Hexamethylenetetramine											
Amount, kg.	33	..	..	..	..	..	..	..	..	..	..
Based on phenol, %	3	..	..	..	..	..	..	..	..	..	..
Ammonia (25%)											
Amount, kg.	110	75	60	..	..	7.42	..	..	60	3.75	..
Based on phenol, %	10	5	5	..	..	1.06	..	..	5	0.5	..
Magnesium oxide											
Amount, kg.	11	..	..	..	..	..	20	..	..	..	..
Based on phenol, %	1	..	..	..	..	..	2.5	..	..	..	..
Oxalic acid											
Amount, kg.	..	..	..	4.55–6.50	6.5	..	4	6.5	..	..	..
Based on phenol, %	..	..	..	0.35–0.50	0.5	..	0.5	0.5	..	..	..
Hydrochloric acid (100%)											
Amount, kg.	..	..	..	2.6–4.875	5.2–6.5	..	..	3.9–6.5	..	1.35[c]	1[c]
Based on phenol, %	..	..	..	0.2–0.375	0.4–0.5	..	..	0.3–0.5	..	0.054[d]	0.04[d]
Calcium hydroxide											
Amount, kg.	..	..	..	..	..	..	..	..	3.6	..	..
Based on phenol, %	..	..	..	..	..	..	..	..	0.3	..	..
Water[a], kg.	110	..	..	130	130	70	80	..	..	75	75
Alcohol (denatured), kg.	..	..	500	..	..	90	..	..	500	..	..
YIELD											
Total (based on phenol), %	140	114–115	156	110	110	165	125	110	158	125–128	107–110
Solid resin, %	..	..	91	..	..	..	..	..	97.4	..	..

[a] The phenol is melted by means of a steam coil in the tank car in which it is delivered and is then forced by pressure into the storage tank where it is immediately mixed with 10 percent of water to keep it continuously liquid. In winter the storage tanks are kept at a temperature of 20 to 30° C. by a steam coil, in order to keep the phenol always available in a liquid form which can be easily pumped.
[b] Phenol oil SR I (mixture of phenol and cresol).
[c] 30 percent hydrochloric acid.
[d] Calculated on basis of 100 percent hydrochloric acid.

hydrated by vacuum distillation at 50° C. until the resin in the kettle becomes clear. Then a further 140 kg. of cresol is added and well mixed by subsequent distillation for 5 min. Finally, the alcohol is added and the solution cooled to 20–25° C.

Resin T4 (phenol novolak)

The solution of phenol and formaldehyde is mixed with hot oxalic acid solution by stirring and the first condensation accomplished at boiling temperature. The second condensation with hydrochloric acid is done immediately thereafter. The amounts of the acids and the time of condensation depend on the viscosity desired. Processing data for both molding and laminating phenolic resins are presented in Table III.

After the second condensation is finished, the reaction is stopped by adding cold water. The crude resin is allowed to settle for 30 min. and then forced by pressure into the distillation kettle. It is distilled without vacuum to remove the water until a temperature of 115° C. is reached (usually 2–3 hr.). To remove gas from the melted resin, it is put under vacuum for 5 to 10 min.

Resin T4N (phenol novolak, neutralized)

The phenol and formaldehyde are precondensed with oxalic acid for 60 minutes. Then the hydrochloric

Table II.—Properties of I. G. Molding and Laminating Phenolic Resins

Property	*Resin T1*		*Resin T3* — *T3N*	*T3E*	*T3F*	*Resin T3SM*	*Resin T4*				
Viscosity											
Solution as is, cp.	...	...	...	...	...	200–250	...	...	....	.....	.....
Ostwald (in acetone 1:1), cp.	12–14	18–22	11–13	13–16	18–22	....	...	...	....	.....	.....
Hoeppler (in alcohol 1:1), cp.	30–40	50–70	40–50	50–70	80–100	....	50–65	80–90	90–110	110–140	140–180
Softening point											
(Kraemer-Sarnow), ° C.	45–55	55–65	50–55	55–60	65–70	....	55–58	65–70	68–75	70–80	75–85
Water content, percent	8–10	6–8	3–4	3–4	3–4	....	3–4	3–4	3–4	3–4	3–4
Free phenol, percent	6–8	6–8	...	...	...	....	...	...	....	.....	.....
Free cresol, percent	...	...	10–13	10–12	8–10	....	6.0	3.5	3.0	2.6	2.5
Loss on drying (90 min. at 150° C),											
percent	10–12	8–10	8–9	7–8	6–7	41.6	...	...	....	.....	.....

Resin No.	Viscosity (Hoeppler in alcohol 1:1)	Formaldehyde (30%) Per 100 parts by weight of phenol	Formaldehyde (30%) Per mol of phenol	Oxalic acid	Hydrochloric acid (100%)	Time for 1st condensation	Time for 2nd condensation
	cp.	*parts by wt.*	*mol*	*%*	*%*	*min.*	*min.*
T4	50–65	86–88	0.81–0.825	0.35	0.2–0.225	50	20–25
	80–90	90	0.85	0.35–0.4	0.25–0.325	60	30–35
	90–110	90	0.85	0.5	0.35	60	30–35
	110–140	90–92	0.85–0.865	0.5	0.35–0.375	60	35
	140–180	92–94	0.865–0.885	0.5	0.35–0.375	60	35–45
T4N	80–90	88	0.825	0.5	0.4	60	35
	90–100	90	0.85	0.5	0.4–0.5	60	35
	100–120	92	0.865	0.5	0.5	60	35
	120–140	94	0.885	0.5	0.5	60	35
T24E	75–90	83–85	0.83–0.85	0.5	0.3–0.4	60	30–35
	90–110	88	0.88	0.5	0.4	60	35
	110–130	88–90	0.88–0.90	0.5	0.5	60	35
	130–150	92	0.92	0.5	0.5	60	35

Table III.—Processing Data for I. G. Molding and Laminating Phenolic Resins

acid in 15 percent solution is added at once and the batch is further condensed for 35 minutes. The amounts of the acids and the time of condensation depend on the viscosity desired, as shown in Table III. The reaction is stopped by adding cold water, and the crude resin is allowed to settle for 30 minutes.

After the supernatant water is removed, the resin is dehydrated by heating to 115° C. without vacuum. As soon as the resin becomes clear at 100° C., it is neutralized with sodium hydroxide (36 percent aqueous solution); this requires about 30–40 percent of the amount equivalent to the acids added.

Resin T5 (phenol resol, low viscosity)

The materials, without the alcohol, are condensed at 90° C. for 5–6 hr., for exactly 25 minutes beyond the point of turbidity. The batch is then vacuum dehydrated until a sample remains clear when cooled. Then the resin is cooled to 20° C. The dry residue of this resin at 150° C. is determined and should amount to 62–65 percent. Then the alcohol is added, followed by sufficient water to bring the dry residue to 55 percent.

Resin T21A (ammonia-free phenol resol in solid form)

The phenol and formaldehyde are condensed with the oxalic acid at the boiling point for 20 min. beyond the point of turbidity (40–45 min. total) and cooled at once. At 70° C., the magnesium oxide is added after being mixed to a paste with water. The condensation is continued further for 60 min. during which the temperature is brought down to 60° C. and kept at this point. The resin is vacuum dehydrated at 50° C. by heating with steam at 3 atmospheres pressure until the resin starts to become viscous after having become clear. Then the source of heat is changed to hot water and the distillation is continued until the required viscosity is reached (final temperature 68–72° C.). The resin is emptied under pressure through a screen into galvanized pans lined with parchment paper and cooled under water. The total time required is 12–15 hr., depending on the size of the batch.

Resin T24E (phenol-cresol novolak, neutralized)

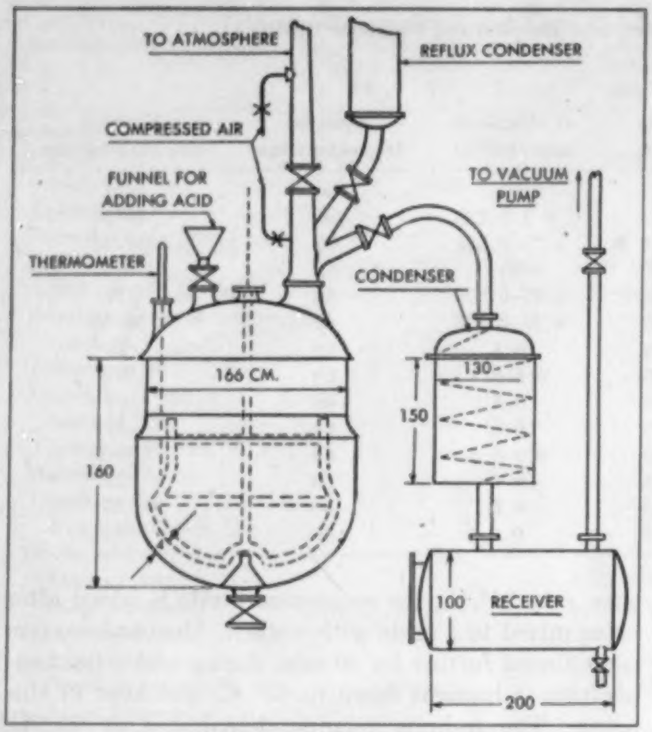
The method of preparation is the same as for Resin T4N. The amounts of the acids and the time of condensation depend on the viscosity desired (Table III).

Resin T43SM

The xylenol, formaldehyde and ammonia are condensed for 75 min. at 80° C. and subsequently dehydrated by vacuum distillation at 50–55° C. At the beginning of the distillation (50° C.) the calcium hydroxide, mixed to a paste with water, is added. Water is removed until a sample of the resin remains clear

Table II (continued)—Properties of I. G. Molding and Laminating Phenolic Resins

Resin T4N				Resin T5	Resin T21A	Resin T24E				Resin T43SM	Resin 221	Resin HLS
...	....	.....	.....	80–100	...	...	....	.....	.....	150–200	2000–5000	80–140
...	....	.....	.....	....	...	...	....	.....	.....	.....	....	.....
80–90	90–100	100–120	120–140	....	85	75–90	90–110	110–130	130–150	.....	....	.....
65–70	70–75	75–80	80–85	....	67	70–75	75–80	78–85	82–90	.....	....	74–82
3–4	3–4	3–4	3–4	....	6.5	...	....	.....	.....	.....	14–18	2.5–5.0
5.1	3.4	3.3	3.2	15–21	7.0	5.0	3.6	3.2	2.6	.....	8–12	3.0–5.0
...	....	.....	.....	....	...					.....	....	.....
...	....	.....	.....	45–46	9.0	...	....	.....	.....	36–40	25–30	.....



General view of the resin manufacturing unit

when cooled. Then the alcohol is added and well mixed, and the batch is cooled.

Resin 221 (phenol novolak, liquid)

The phenol, formaldehyde and hydrochloric acid are condensed at the boiling point for 35 min. beyond the point of turbidity and then at once vacuum dehydrated at 60° C. As soon as the temperature has dropped to 60° C. under vacuum, the ammonia is added. The distillation is continued until a sample remains clear when cooled. Then the resin is cooled.

Resin HLS (phenol novolak, solid)

The mixture is condensed at the boiling point for 70-80 minutes. It is then immediately vacuum dehydrated at 60° C. until the resin starts to become viscous. This will occur about 15 min. after the resin has become clear. It is further heated to 115° C. without vacuum and then poured into pans.

Table IV.—Data for I. G. Phenolic Laminating Varnishes (50% Resin Content)

	Varnish T1/LTx	*Varnish T3/LTx*	*Varnish T4/LTx*
COMPOSITION			
Resin			
Type	T1	T3	T4
Viscosity[a], cp.	50–70	50–60	80–90
Amount, kg.	1400	1500	1200
Alcohol (denatured), kg.	1100	1150	1300
Magnesium stearate, kg.	29.5	...	26.5
Calcium hydroxide, kg.	...	7.5	...
Hexamethylene-tetramine, kg.	...	...	215
YIELD (based on total composition), %	96–98	98	98
PROPERTIES			
Viscosity, cp.	120 (80–160)	250 (200–300)	180 (150–200)
Loss on drying (90 min. at 150° C.), %	48 (47.5–50)	49 (48–50)	50 (48–50)

a Resins of other viscosities may be required for special purposes.

Laminating varnish T1/LTx (see Table IV)

The alcohol is put into the kettle. The pulverized resin is added in portions with constant stirring. It takes about 10–14 hr. to dissolve the resin at 20–25° C. Then the temperature is raised to 30° C. for 4 hr. to dissolve the last remnants of the resin. After cooling to 25° C., the dry magnesium stearate is added through a screen and dispersed in the resin by stirring for 30 min.

Laminating varnish T3/LTx (see Table IV)

The alcohol is put into the kettle. The pulverized resin is added in portions (*Please turn to page 206*)

Some conception of the work that was being done in Germany can be gleaned from this general view of resin manufacturing unit

Effect of temperature and humidity on mechanical properties of molded cellulose acetate[1]

by W. E. WELCH[2], R. F. HAYES[2,3], T. S. CARSWELL[2,4] and H. K. NASON[2,5]

Four molding compound formulations, covering a range of flow gradings, were prepared from medium-acetyl (37.7 percent) and four from high-acetyl (41.0 percent) cellulose acetate. Test specimens were injection molded from these formulations and physical properties were determined by standard A.S.T.M. procedures. The effects on yield and ultimate strengths in tension, elongation, modulus of elasticity, yield strength in flexure and impact strength, resulting from variations in ambient temperature over the range from —25° C. (—13° F.) to 80° C. (176° F.), and of variation in relative humidity at 25° C. (77° F.) over the range from 0 percent to saturation, were determined, and the results are shown in graphical form. Some data showing the effect of exposure to weather on tensile properties of two of the formulations are presented also. The practical importance of these data is discussed.

IN RECENT years, plastic materials have been used to an increasing extent for applications where dependable performance must be assured over a wide range of ambient atmospheric conditions. Intelligent engineering design for such applications requires data on the mechanical behavior of the materials under all conditions which may be encountered in service, and such data have been scarce. The work reported herein was undertaken to provide information on the mechanical properties of cellulose acetate molding compositions over the customary range of atmospheric temperatures and humidities.

Materials

Eight typical cellulose acetate molding compositions were prepared by standard commercial technics—four from cellulose acetate of medium-acetyl content (37.7 percent) and four from cellulose acetate of high-acetyl content (41.0 percent). Mixtures of phthalate and phosphate esters were used as plasticizers. The finished compositions, which were representative of commercial products, are further characterized in Table I.

Specimens were injection molded on a 2-oz. Reed-Prentice machine, using pre-dried compositions (1.5 to 2 hr. at 200° F.) under conditions experimentally determined to be optimum for each material and molded shape. The moldings were thoroughly randomized before selecting groups of specimens for various tests.

Test methods

A.S.T.M. test methods were used throughout. The pertinent references and brief particulars of the procedures are given in the following paragraphs:

Tensile properties—A.S.T.M. D 638–41 T, Type II specimen. Tests were run at a crosshead speed of 0.2 in. per min., using a universal testing machine. Data on yield strength, ultimate strength and ultimate elongation, and stress-strain curves, from which moduli of elasticity were calculated, were obtained. At least six tests were made at every environmental condition.

Flexural properties—A.S.T.M. D 650–42 T. Specimens 0.5 by 0.5 by 5.0 in. were used. The flexure jig was adjusted to give a span-depth ratio of 8:1, and tests were made at a crosshead speed of 0.05 in. per minute. Maximum fiber stress was calculated by the usual formula. At least five tests were made at each condition.

Impact strength—A.S.T.M. D 256–43 T. Specimens 0.5 by 0.5 by 5.0 in., with a machined notch in the center, were broken by the Charpy method, using an impact tester of 100 in.-lb. capacity. Appropriate notches were then machined into the broken halves, and these, after reconditioning, were tested by the Izod method. All notching was done at 400 r.p.m. with a single-tooth diamond milling cutter, and representative specimens were examined microscopically to insure conformance to specifications for contour of the notch. At least five Charpy tests and ten Izod tests were made at each condition.

Distortion temperature—A.S.T.M. D 648–41 T. Specimens 0.5 by 0.5 by 5.0 in. were conditioned at 50° C. (122° F.) for 48 hr., cooled to room temperature in a desiccator over calcium chloride and stored therein until tested.

Flow temperature—A.S.T.M. D 569–43. Molding composition granules were conditioned for 25 min. at 100° C. (212° F.), cooled in a desiccator over calcium

[1] Presented at the 1946 Annual Meeting of the American Society for Testing Materials and published here through the courtesy of that organization.
[2] Research Dept., Plastics Div., Monsanto Chemical Co.
[3] Gering Products Co.
[4] Monsanto Chemical Co.
[5] Central Research Dept., Monsanto Chemical Co.

Table I.—Cellulose Acetate Molding Compositions

Sample No.	A.S.T.M. classification[a] Type	Grade	A.S.T.M. flow temperature		Acetyl content of base acetate	Plasticizer content[b]	A.S.T.M. distortion temperature	
			° C.	° F.	%	%	° C.	° F.
1	II	7	158	316	37.7	28.6	75.5	168
4	I	2	149	300	37.7	28.4	73.0	163
2	III	9	146	295	37.7	32.3	72.5	163
3	III	10	135	275	37.7	37.2	66.0	151
5	IV	13	160	320	41.0	25.0	69.5	157
8	IV	14	152	306	41.0	27.0	67.5	154
6	IV	15	145	293	41.0	30.9	60.0	145
7	III	10	134	273	41.0	35.6	50.5	123

[a] A.S.T.M. Specification D 706–44 T. Conformance to these classifications is not exact in every case, but the materials have been placed in the group to which they most nearly belong.
[b] Sample Nos. 1, 2, 3, 5, 6 and 7 contain a mixture of phthalate and phosphate esters; Sample Nos. 4 and 8 contain phthalate esters only.

chloride, formed into pellets $^3/_8$ in. in diameter and $^3/_8$ in. high in a pelleting press, and tested in the Rossi-Peakes apparatus at 1500 p.s.i. Determinations were made at several temperatures, the results were plotted and the flow temperatures were determined by interpolation as prescribed.

Moisture content—Actual water content of conditioned specimens was determined by planing into thin chips, soaking these in methanol, and determining water by titration with Karl Fischer reagent.[6] A blank was run with methanol alone and the value obtained subtracted from all determinations.

[6] J. Mitchell, Jr., "Determination of Water in Native and Processed Cellulose," Ind. Eng. Chem., Anal. Ed. *12*, 390–1 (1940).

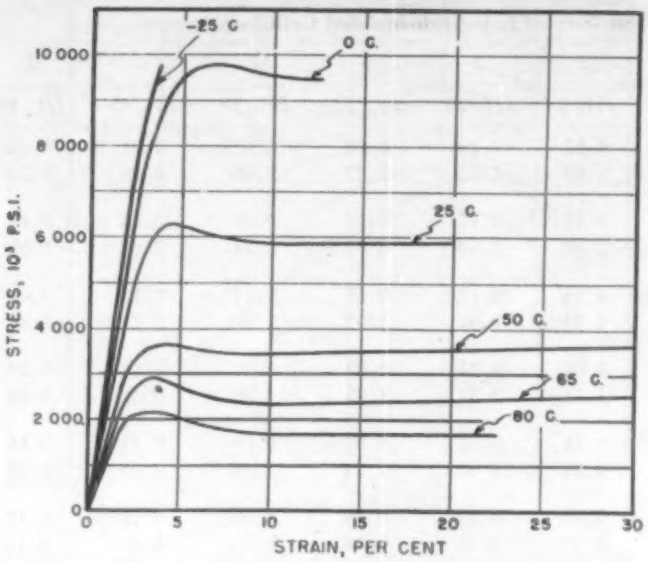
Conditioning

All specimens were taken directly from the molding machine, placed in sealed metal containers over anhydrous calcium chloride and allowed to remain until needed. Specimens for flow temperature and distortion temperature tests were conditioned as described in the preceding section.

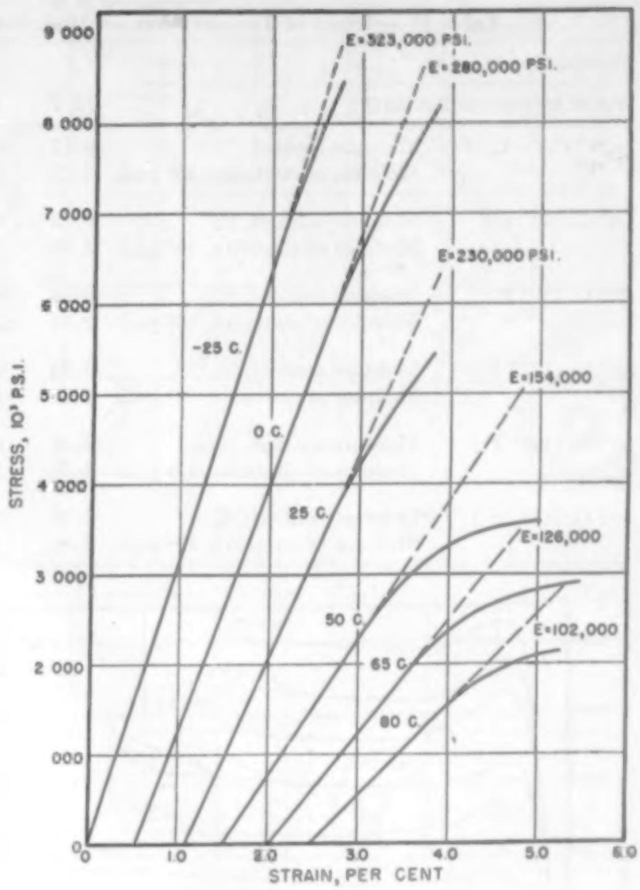
For the mechanical tests at various temperatures, the dry specimens were heated in an air circulating oven or cooled in a special chamber using dry ice as the refrigerant, as required, until thermal equilibrium was established but in no case for less than one hour. They were then transferred quickly to the testing ma-

Table II.—Effect of Relative Humidity at 25° C. (77° F.) on Tensile Properties of Injection Molded Cellulose Acetate

Formulation No.		*1*	*4*	*2*	*3*	*5*	*8*	*6*	*7*
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
Dry 0% R.H.	Moisture content, %	0.18	0.19	0.14	0.13	0.12	0.13	0.11	0.09
	Tensile yield stress, p.s.i.	6250	5640	4750	3530	6150	5300	4370	3510
	Ultimate tensile stress, p.s.i.	5880	5100	4860	3430	5510	4600	4440	3190
	Elongation at break, %	22.9	23.9	27.9	38.5	15.6	19.8	42.6	38.1
20% R.H.	Moisture content, %	0.55	0.55	0.44	0.39	0.43	0.41	0.34	0.32
	Tensile yield stress, p.s.i.	5770	5010	4450	3400	5740	4910	4140	3380
	Ultimate tensile stress, p.s.i.	5230	4360	3870	3160	5060	4170	4000	2910
	Elongation at break, %	23.2	21.9	26.9	38.0	18.5	17.4	38.9	34.0
35% R.H.	Moisture content, %	0.82	0.81	0.72	0.63	0.64	0.57	0.51	0.45
	Tensile yield stress, p.s.i.	5350	4900	4270	3300	5310	4740	3990	3340
	Ultimate tensile stress, p.s.i.	4720	4220	3730	3070	4440	3900	3780	2890
	Elongation at break, %	25.9	20.8	24.7	36.8	28.4	18.9	41.8	37.6
50% R.H.	Moisture content, %	1.36	1.45	1.19	1.12	1.08	1.07	0.95	0.88
	Tensile yield stress, p.s.i.	4270	4000	3510	2540	4530	4050	3300	2740
	Ultimate tensile stress, p.s.i.	4270	4000	3100	2380	4530	3370	3300	2740
	Elongation at break, %	31.6	26.2	27.9	43.7	30.3	22.3	44.0	39.9
65% R.H.	Moisture content, %	1.92	1.90	1.71	1.54	1.47	1.48	1.31	1.22
	Tensile yield stress, p.s.i.	4080	3860	3330	2510	4390	3910	3240	2510
	Ultimate tensile stress, p.s.i.	3460	3040	2620	2160	3580	3110	3040	2060
	Elongation at break, %	30.3	23.3	31.4	46.4	28.6	18.0	45.9	37.9
80% R.H.	Moisture content, %	2.65	2.62	2.44	2.15	2.08	1.99	1.81	1.72
	Tensile yield stress, p.s.i.	3380	3200	2730	2020	3800	3410	2730	2200
	Ultimate tensile stress, p.s.i.	2890	2520	2200	1830	3080	2660	2700	1900
	Elongation at break, %	35.5	28.1	38.3	52.2	31.5	16.7	49.5	42.9
Saturated atmosphere	Moisture content, %	5.50	5.56	5.06	4.68	3.67	3.84	3.32	3.12
	Tensile yield stress, p.s.i.	2320	1980	1820	1410	2930	2610	2050	1410
	Ultimate tensile stress, p.s.i.	1480	1600	1390	1070	2230	2000	2040	1380
	Elongation at break, %	37.8	22.4	32.8	27.5	31.2	14.3	55.7	52.7



1—*Typical stress-strain curves for injection molded cellulose acetate (Formulation No. 1; A.S.T.M. Type II, Grade 7)*



2—*Typical initial portion of stress-strain curves for injection molded cellulose acetate (Formulation No. 1; A.S.T.M. Type II, Grade 7)*

chine. Impact tests were run immediately upon completion of the transfer. For tensile and flexural tests, temperature-controlled enclosures which have been described in previous publications[7, 8] were used, and specimens were stored within these enclosures until needed for testing. In every case, the test specimens were within ±3° C. (±5.4° F.) of the nominal tem-

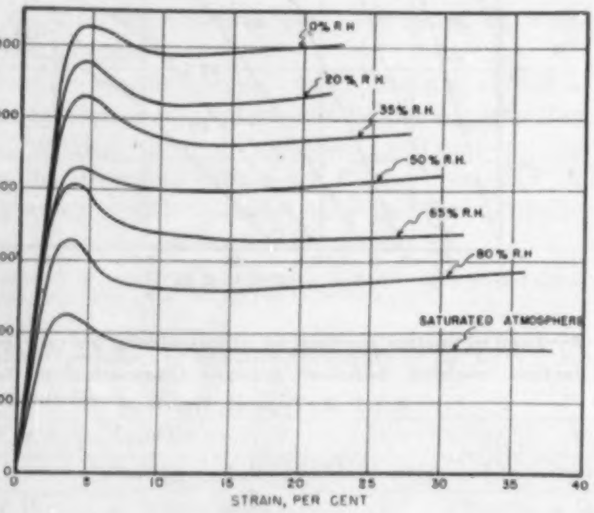
[7] T. S. Carswell, R. F. Hayes and H. K. Nason, "Physical Properties of Polystyrene as Influenced by Temperature," Ind. Eng. Chem. 34, 454–7 (1942).
[8] T. S. Lawton, Jr., T. S. Carswell and H. K. Nason, "Effect of Some Environmental Conditions on the Mechanical Properties of Cellulose Acetate and Cellulose Nitrate Plastic Sheets," Trans. A.S.M.E. 67, 23–30 (Jan. 1945); Modern Plastics 22, 145–152, 188 (Oct. 1944).

Table III.—Effect of Temperature on Tensile Properties of Injection Molded Cellulose Acetate

Formulation No.		*1*	*4*	*2*	*3*	*5*	*8*	*6*	*7*
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
−25° C. (−13° F.)	Moisture content, %	0.17	0.21	0.17	0.18	0.20	0.17	0.21	0.16
	Tensile yield stress, p.s.i.	..	..	..	..	..	...	..	..
	Ultimate tensile stress, p.s.i.	8540	9400	7950	6490	8710	9380	7710	6370
	Elongation at break, %	3.2	3.9	3.0	4.4	2.8	4.5	4.6	3.6
0° C. (32° F.)	Moisture content, %	0.18	0.16	0.15	0.17	0.16	0.19	0.13	0.12
	Tensile yield stress, p.s.i.	9570	8200	7530	5690	9190	7790	7040	5670
	Ultimate tensile stress, p.s.i.	9300	8060	7410	5730	9030	..	6820	5490
	Elongation at break, %	13.3	12.8	16.4	18.3	5.9	12.5	17.4	12.0
25° C. (77° F.)	Moisture content, %	0.18	0.19	0.14	0.13	0.12	0.13	0.11	0.09
	Tensile yield stress, p.s.i.	6250	5640	4750	3530	6150	5300	4370	3510
	Ultimate tensile stress, p.s.i.	5880	5100	4860	3430	5510	4600	4440	3190
	Elongation at break, %	22.9	23.9	27.9	38.5	15.6	19.8	42.6	3811
50° C. (122° F.)	Moisture content, %	0.33	0.38	0.36	0.21	0.29	0.37	0.38	0.29
	Tensile yield stress, p.s.i.	3660	3390	2690	2040	3480	3080	2405	1710
	Ultimate tensile stress, p.s.i.	3730	3080	2570	2160	3250	2514	2500	1620
	Elongation at break, %	30.3	27.1	31.6	43.0	32.0	22.6	37.7	32.9
65° C. (149° F.)	Moisture content, %	0.08	0.11	0.10	0.12	0.07	0.09	0.11	0.11
	Tensile yield stress, p.s.i.	2900	2590	1860	1140	2680	2150	1380	830
	Ultimate tensile stress, p.s.i.	2540	2160	1610	1200	2150	1610	1370	850
	Elongation at break, %	29.8	25.4	30.9	41.5	25.8	17.1	33.1	31.2
80° C. (176° F.)	Moisture content, %	0.16	0.30	0.15	0.28	0.20	0.19	0.18	0.17
	Tensile yield stress, p.s.i.	2140	2110	1390	550	1780	1530	490	210
	Ultimate tensile stress, p.s.i.	2140	2110	1390	550	1780	1530	490	210
	Elongation at break, %	21.2	11.1	22.7	33.7	15.8	14.6	33.4	31.4

Table IV.—Effect of Temperature on Modulus of Elasticity of Injection Molded Cellulose Acetate

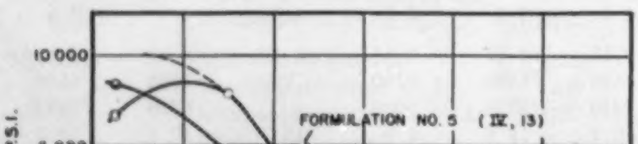
Formulation No.		*1*	*4*	*2*	*3*	*5*	*8*	*6*	*7*
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
−25° C. (−13° F.)	Moisture content, %	0.17	0.21	0.17	0.18	0.20	0.17	0.21	0.16
	Modulus of elasticity, 10^5 p.s.i.	3.23	3.13	3.03	2.33	3.27	2.96	2.06	2.50
0° C. (32° F.)	Moisture content, %	0.18	0.16	0.15	0.17	0.16	0.19	0.13	0.12
	Modulus of elasticity, 10^5 p.s.i.	2.80	2.44	2.09	1.69	2.77	2.34	2.02	1.93
25° C. (77° F.)	Moisture content, %	0.18	0.19	0.14	0.13	0.12	0.13	0.11	0.09
	Modulus of elasticity, 10^5 p.s.i.	2.30	2.28	1.84	1.47	2.37	2.18	1.70	1.45
50° C. (122° F.)	Moisture content, %	0.33	0.38	0.36	0.21	0.29	0.37	0.38	0.29
	Modulus of elasticity, 10^5 p.s.i.	1.54	1.49	1.11	0.71	1.41	1.36	0.92	0.60
65° C. (149° F.)	Moisture content, %	0.08	0.11	0.10	0.12	0.07	0.09	0.11	0.11
	Modulus of elasticity, 10^5 p.s.i.	1.26	1.10	0.87	0.50	1.24	1.08	0.59	0.38
80° C. (176° F.)	Moisture content, %	0.16	0.30	0.15	0.28	0.20	0.19	0.18	0.17
	Modulus of elasticity, 10^5 p.s.i.	1.02	1.00	0.63	0.25	0.78	0.65	0.20	0.10



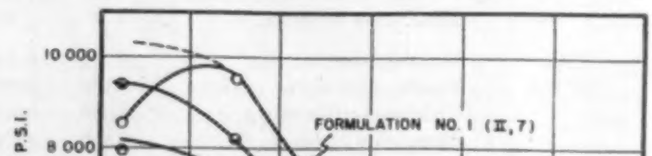
3—Effect of humidity on stress-strain curve for injection molded cellulose acetate (Formulation No. 1; A.S.T.M. Type II, Grade 7)

peratures during the testing (A.S.T.M. D 759–44 T).

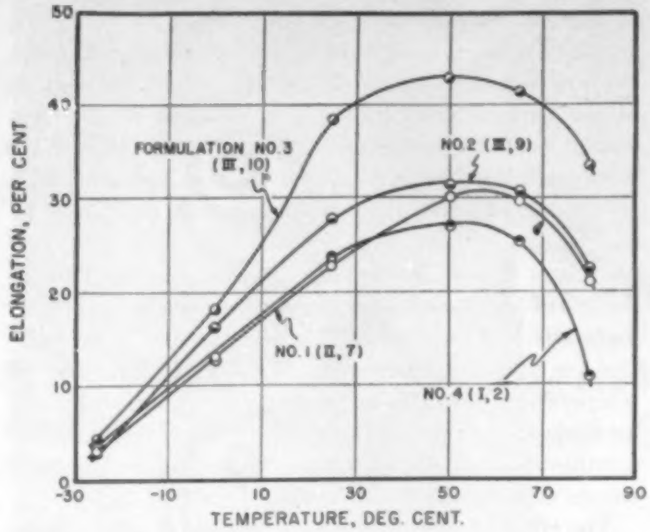
For the mechanical tests at various relative humidities, specimens were stored at the desired humidity at 25° C. (77° F.) for three to seven weeks, depending upon thickness. Representative samples at each condition were taken for analysis at the time of testing. Relative humidity conditions of 20 and 35 percent were obtained in a special test room, the air of which was conditioned by mechanical means. A relative humidity of 50 percent was obtained in the main physical laboratory, whose atmosphere is maintained at the standard laboratory conditions of 25 ± 1.1° C. (77 ± 2° F.) and 50 ± 2 percent relative humidity (A.S.T.M. D 618–44 T). Other conditions were obtained by storage of the specimens in sealed containers over appropriate aqueous solutions: saturated sodium nitrate for 65 percent, saturated ammonium chloride for 80 percent, and distilled water for a saturated atmosphere (sometimes erroneously designated as "100 percent relative humidity"). The relative humidity for each condition



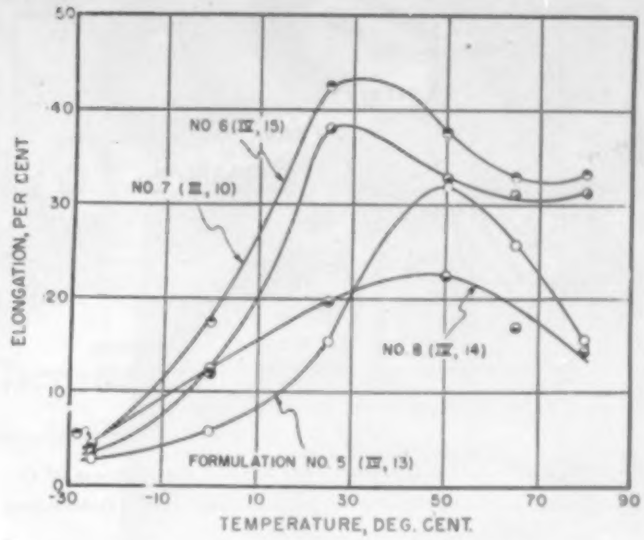
4—Effect of temperature on tensile yield stress of injection molded cellulose acetate (medium-acetyl formulations)



5—Effect of temperature on tensile yield stress of injection molded cellulose acetate (high-acetyl formulations)



6—Effect of temperature on elongation of injection molded cellulose acetate (medium-acetyl formulations)



7—Effect of temperature on elongation of injection molded cellulose acetate (high-acetyl formulations)

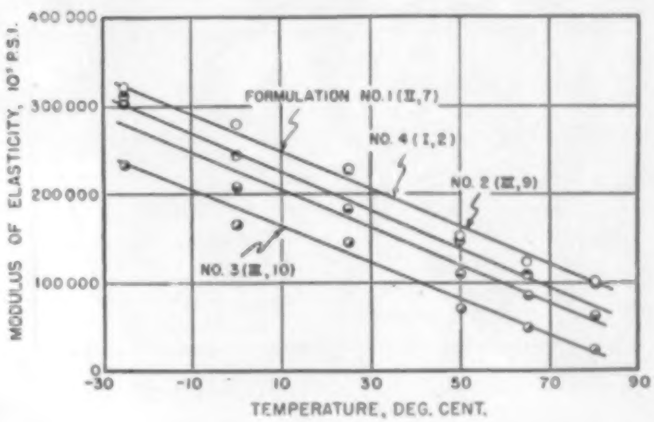
was checked with a standardized hair hygrometer, and is believed to have been within ±2 percent of the nominal value in every case. Specimens were tested as rapidly as possible after removal from the conditioning chamber.

Despite the long time allowed for conditioning, it is obvious from comparison of moisture contents that the thicker specimens had not reached true equilibrium.

Test Results

Typical stress-strain curves (in this case for formulation No. 1) at the various test temperatures are shown in Fig. 1. The initial portions of these curves are shown to a larger scale in Fig. 2. Similarly, typical stress-strain curves for this same formulation at various relative humidities at 25° C. (77° F.) are shown in the graph Fig. 3.

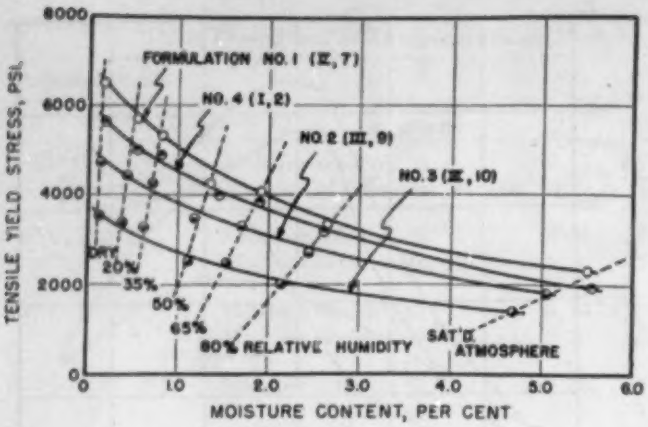
The data on the tensile properties of *dry* specimens



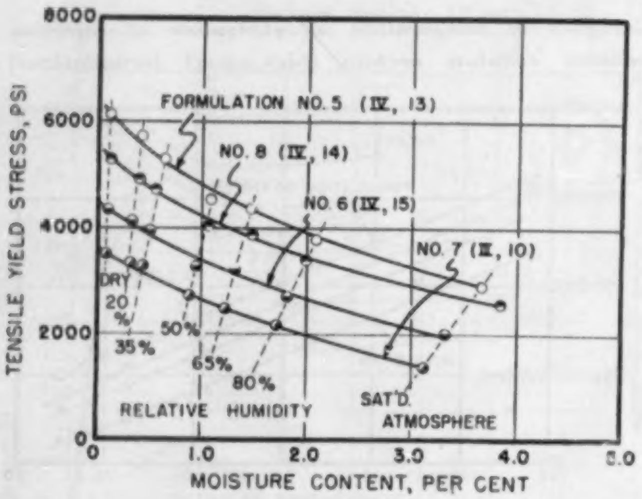
8—Effect of temperature on modulus of elasticity of injection molded cellulose acetate (these formulations are for medium acetyl)

Table V.—Effect of Relative Humidity at 25° C. (77° F.) on Modulus of Elasticity of Injection Molded Cellulose Acetate

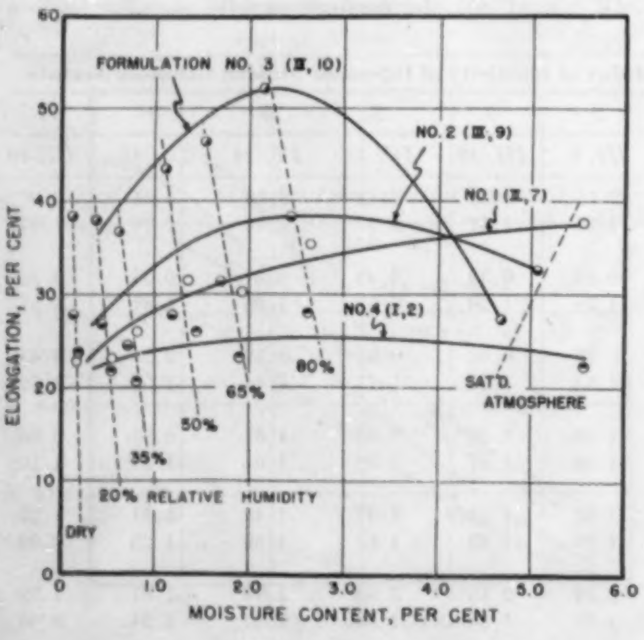
Formulation No.		*1*	*4*	*2*	*3*	*5*	*8*	*6*	*7*
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
Dry 0% R.H.	Moisture content, %	0.18	0.19	0.14	0.13	0.12	0.13	0.11	0.09
	Modulus of elasticity, 10^5 p.s.i.	2.30	2.28	1.84	1.47	2.37	2.18	1.70	1.45
20% R.H.	Moisture content, %	0.55	0.55	0.44	0.39	0.43	0.41	0.34	0.32
	Modulus of elasticity, 10^5 p.s.i.	2.12	2.05	1.76	1.28	2.11	1.96	1.61	1.37
35% R.H.	Moisture content, %	0.82	0.81	0.72	0.63	0.64	0.57	0.51	0.45
	Modulus of elasticity, 10^5 p.s.i.	1.99	1.86	1.67	1.27	1.77	1.84	1.56	1.35
50% R.H.	Moisture content, %	1.36	1.45	1.19	1.12	1.08	1.07	0.95	0.88
	Modulus of elasticity, 10^5 p.s.i.	1.72	1.69	1.46	1.17	1.69	1.65	1.39	1.10
65% R.H.	Moisture content, %	1.92	1.90	1.71	1.54	1.47	1.48	1.31	1.22
	Modulus of elasticity, 10^5 p.s.i.	1.61	1.61	1.29	1.03	1.61	1.60	1.25	1.02
80% R.H.	Moisture content, %	2.65	2.62	2.44	2.15	2.08	1.99	1.81	1.72
	Modulus of elasticity, 10^5 p.s.i.	1.47	1.41	1.23	0.89	1.58	1.47	1.24	0.93
Saturated atmosphere	Moisture content, %	5.50	5.56	5.06	4.68	3.67	3.84	3.32	3.12
	Modulus of elasticity, 10^5 p.s.i.	0.99	1.02	0.83	0.62	1.36	1.23	0.95	0.68



9—*Effect of relative humidity on tensile yield stress of injection molded cellulose acetate (medium-acetyl formulae)*



10—*Effect of relative humidity on tensile yield stress of injection molded cellulose acetate (the formulations tested were for high acetyl)*



11—*Effect of relative humidity on elongation of injection molded cellulose acetate (medium-acetyl formulations)*

at various temperatures are summarized in Table III, and the corresponding data at various relative humidities are summarized in Table II. Moisture content at the time of testing is shown for each formulation and at each test condition. Stress values shown are nominal values in every case.[9] The corresponding data on moduli of elasticity are summarized in Tables IV and V.

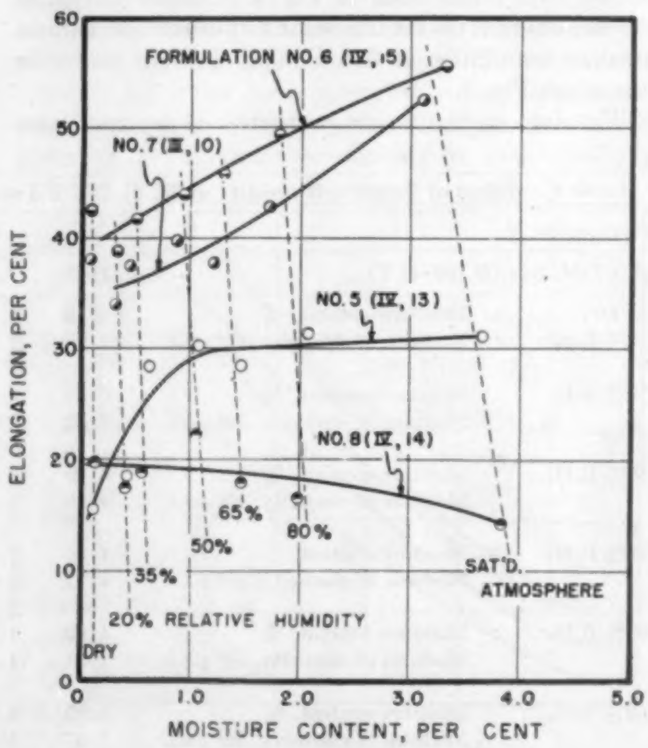
Figures 4 and 5 show in graphical form the influence of temperature on the upper yield stress of these materials, and Figs. 6 and 7 summarize similar information on ultimate elongation. In Fig. 8, the effect of temperature on modulus of elasticity is shown for the medium-acetyl formulations. Data for the high-acetyl formulations are not shown since they follow the same trends at generally lower levels.

The effect of humidity on upper yield stress is shown in Figs. 9 and 10, on ultimate elongation in Figs. 11 and 12 and on modulus of elasticity for the medium-acetyl formulations in Fig. 13. (The curves for the high-acetyl formulations are very similar.) The abscissae represent moisture contents of the specimens when tested; relative humidity contours are shown by the broken lines.

The effects of temperature and of relative humidity on flexural strength are shown in Tables VI and VII. These effects are shown graphically in Figs. 14 and 15 for the medium-acetyl formulations.

Data on the effect of temperature on impact strength are summarized in Table VIII and the Izod data are shown graphically in Fig. 16 for the medium-acetyl formulations. The corre- (*Please turn to page 196*)

[9] A.S.T.M. D 638-44 T describes the terms used in this paper.



12—*Effect of relative humidity on elongation of injection molded cellulose acetate (high-acetyl formulations)*

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General

NEW PLASTIC FILMS—THEIR PACKAGING QUALITIES. W. H. Aiken. Modern Packaging *19*, 141–4, 172 (May 1946). The properties of a satisfactory plastic packaging film are described. The general characteristics of regenerated cellulose, cellulose acetate, ethyl cellulose, cellulose nitrate, rubber hydrochloride, polyvinylidene chloride, polyvinyl chloride acetate, polyethylene, nylon, polyvinyl alcohol and polystyrene film are described and evaluated for use in packaging. Data on the water vapor resistance of these materials are presented.

POSTWAR WOOD FINISHES AND SPECIALIZED WOOD TREATMENT. H. E. Smith. Mechanical Eng. *68*, 425–6 (May 1946). The results expected of postwar wood finishes and their development from the newer plastic materials are discussed.

PLASTICS IN THE RUBBER INDUSTRY. H. A. Winkelmann. India Rubber World *113*, 799–804 (March 1946). The properties and applications of various resin-rubber combinations are described.

POROUS HARD RUBBER. T. R. Dawson and E. A. M. Thomson. J. Rubber Research *14*, 179–89 (1945). The various processes for making porous hard rubber are reviewed. Eighty-five references are included.

POST-FORMING DEVELOPMENTS DURING THE WAR AND THEIR APPLICATIONS TO PEACETIME PRODUCTS. W. I. Beach. India Rubber World *113*, 825–7 (March 1946). The developments and applications of post-formed laminates are reviewed.

DENTURE BASE MATERIAL (ACRYLIC RESIN OR MIXTURES OF ACRYLIC AND OTHER RESINS). Federal Specification U-D-226 (Sept. 12, 1941). The requirements of an acrylic resin for use in denture bases are given.

Materials

PREPARATION AND POLYMERIZATION OF THE SIX NUCLEAR ISOMERIC DICHLOROSTYRENES. C. S. Marvel, C. G. Overberger, R. E. Allen, W. H. Johnston, J. H. Saunders and J. D. Young. J. Am. Chem. Soc. *68*, 861–4 (May 1946). The synthesis and polymerization of the nuclear isomeric dichlorostyrenes are described. The polymers of these dichlorostyrenes are briefly characterized. The molecular weights range from 11,000 to 41,000 and the softening points vary from 190 to 240° C.

POLYMERIZATION OF *p*-CHLOROSTYRENE IN THE PRESENCE OF POLYMETHYL ACRYLATE. R. B. Carlin and N. E. Shakespeare. J. Am. Chem. Soc. *68*, 876–8 (May 1946). Evidence is presented to show that the thermal polymerization of *p*-chlorostyrene in the presence of polymethylacrylate at 50° C. produces some polymer molecules which contain units of both kinds. In the light of available evidence, a chain transfer mechanism appears to offer the best explanation of the results, although other mechanisms cannot be excluded.

STRUCTURE OF ETHYLENE POLYSULFIDES. H. E. Westlake, Jr., M. G. Mayberry, M. H. Whitlock, J. R. West and G. J. Haddad. J. Am. Chem. Soc. *68*, 751–3 (May 1946). Ethylene reacted with sulfur with or without solvents or pressure to form a xylene-insoluble polymer and a soluble oil, part of which was volatile. The various products were investigated and structures were postulated from the experimental evidence.

PREPARATION AND POLYMERIZATION OF SOME SUBSTITUTED STYRENES. C. S. Marvel, C. G. Overberger, R. E. Allen and J. H. Saunders. J. Am. Chem. Soc. *68*, 736–8 (May 1946). The preparation of *m*-trifluoromethylstyrene, *m*-methylstyrene, *m*-nitrostyrene and *p*-N,N-dimethylaminostyrene is described. The polymers of these monomers, except *m*-nitrostyrene, were prepared and characterized. The molecular weights were 7300, 33,000 and 1600, respectively. The softening points were 130–155° C., 117–122° C. and 80–95° C., respectively. These polymers are all soluble in benzene.

POLY-ETHENE. R. Houwink. British Plastics *18*, 192–8 (May 1946). The properties of polyethylene are reviewed and compared with other high polymers.

VULCANIZATION OF CELLULOSE MATERIALS. P. V. Afanas'ev and S. E. Bresler. Trudy Konferentsiĭ Vysokomolekulyar Chem. Abstracts *40*, 458–9 (Jan. 20, 1946). Viscose fibers, partially hydrolyzed polyvinyl acetate and polyvinyl alcohol are vulcanized by soaking in certain compounds which are synthesized by condensing pyridine hydrochloride with the *bis*-(chloromethyl) ether of diethylene glycol, *bis*-(chloroethyl) ether, the *tris*-(chloromethyl) ether of glycerol and the *bis*-(chloromethyl) ether of decamethylene glycol. The vulcanized materials swell less in solvents than the unvulcanized original fibers.

RELATION OF CELLULOSE NITRATES OF DIFFERING DEGREES OF HETEROGENEITY TO VOLATILE AND NONVOLATILE SOLVENTS. S. N. Danilov. Trudy Konferentsiĭ Vysokomolekulyar. Chem. Abstracts *40*, 459 (Jan. 20, 1946). Cellulose nitrate is fractionated into fractions with different nitrogen contents by precipitating with water from solutions in acetone and diethyl ether. Swelling pressure on absorption of solvents depends on the degree of nitration and the temperature but not on viscosity. Those fractions with the lowest viscosities in solutions swell most in solvents and form molding compositions which flow more readily than do the other compositions.

OBTAINING VINYL CHLORIDE AND VINYLIDENE CHLORIDE BY PYROLYSIS OF DICHLOROETHANE AND TRICHLOROETHANE AND THEIR COPOLYMERIZATION. P. I. Pavovich. Chem. Abstracts *40*, 495 (Jan. 20, 1946). Dichloroethane and trichloroethane are converted to vinyl chloride and vinylidene chloride, respectively, by passing them over activated carbon at 325–350° C. The products may be copolymerized in aqueous emulsion at pH 2.5–3.5 with a peroxide catalyst such as hydrogen peroxide or benzoyl peroxide.

Molding and fabricating

LOW-COST PLASTIC SHEET BY EXTRUSION. Modern Packaging *19*, 110–112 (May 1946). MODERN PLASTICS *23* 132–136 (May 1946). An extrusion process for making semi-rigid plastic sheet is described. The principle of the new method is continuous extrusion under heat and pressure without the use of solvents. The process forms a continuous sheet of any length in one straight-line operation. The material is extruded from a circular die operating in conjunction with a conventional plastics extrusion machine. The sheeting is drawn from the die as a tube, slit at the bottom as it comes from the die and subsequently made flat in one uninterrupted operation. At the present time sheets of cellulose acetate

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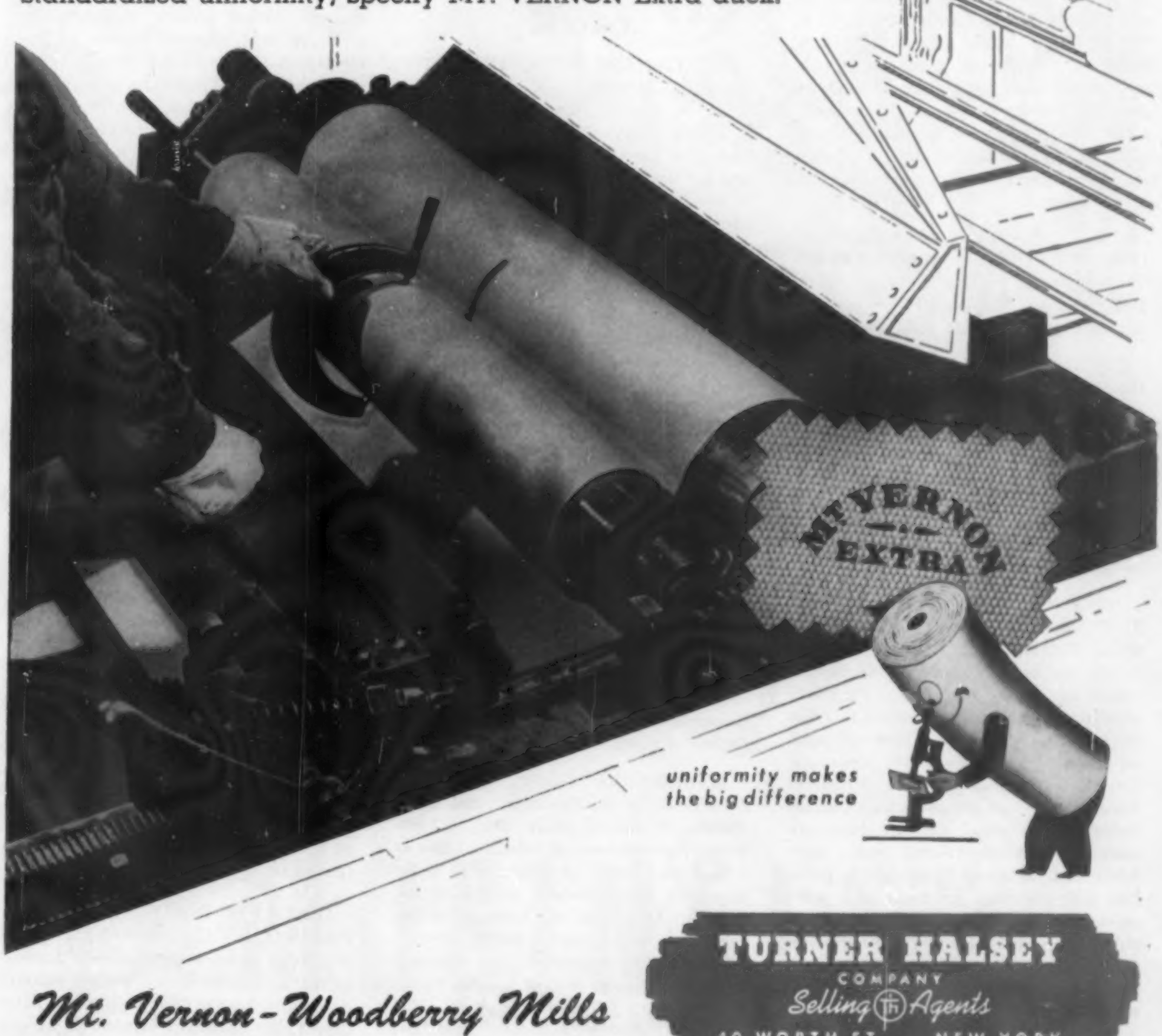

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RADIANT HEATING. British Plastics *18*, 144-9 (Apr. 1946). The theory and applications of radiant heating are reviewed in this article.

A NEW ELECTRONIC HEAT-SEALER. Modern Packaging *19*, 120-1 (May 1946). An electric heat-sealing machine for sealing plastic packages is described. The machine uses 110-volt alternating current, has an output frequency of 60 megacycles and is extremely simple to operate.

Applications

FIRST ALL-PLASTICS RAILWAY BUFFET CAR. Plastics (London) *10*, 245-7 (May 1946). British Plastics *18*, 227-30, 230a (May 1946). MODERN PLASTICS *23* 100-101 (June 1946). A dining car made of plastic materials is described. The walls, bar, partitions, table tops, display cases, light fixtures and curtains are made of plastics. Laminates, vinyls and acrylics account for most of the materials.

UNBREAKABLE MANNEQUINS OF LOW-PRESSURE MOLDED PLASTICS. Pacific Plastics *4*, 19, 37 (May 1946). Mannequins made of low-pressure laminated plastics are described.

FLEXIBLE FUEL CELLS. Plastics (London) *10*, 240-1 (May 1946). Flexible hydrocarbon fuel cells are made of Neoprene cotton-fabric laminate, polyvinyl formal cotton-fabric laminate and with a glycerol-adipate-modified polyvinyl formal cotton-fabric laminate. The latter material remains flexible over a wider temperature range than do the other materials mentioned.

HOUSING LOOKS TO PLASTICS. J. D. Stratton. Plastics (Chicago) *4*, 48-50, 82 (May 1946). Various parts and furnishings made of plastics in an experimental house are described. Plywoods bonded with phenol-formaldehyde resin are used on the exterior. Plywoods used on the floor are bonded with casein adhesives, on the walls with urea-formaldehyde resin and on the eaves with phenol-formaldehyde resin. Cabinet doors are made of phenolic-treated oak, glass fabric and melamine-formaldehyde resin. The wall coverings are made of a polyester-paper laminate and a polyvinyl chloride plastic. Many of the bathroom furnishings are made of methyl methacrylate plastic. Some cupboard doors are made of interlocking strips of cellulose acetate butyrate. Filters are made of polyvinylidene chloride plastic. Various hardware items and furnishings are made of cast phenolics, molded acrylics, decorative laminates, urea-formaldehyde moldings, vinyl resins and cellulose acetate plastics.

LENSES FROM PLASTICS. British Plastics *18*, 219-23 (May 1946). The applications of acrylic and styrene plastics in precision optics are discussed. The molding and finishing of lenses are described in detail.

PLASTICS IN THE CHEMICAL LABORATORY. C. H. Butcher. Plastics (London) *10*, 229-31, 255 (May 1946). The utilization of plastics in making apparatus for the chemical laboratory is described. Present uses are in weight boxes, scale plates, instrument bases, stands for thermostat baths, goggles, tubing and label varnish. Uses being considered are for containers and volume measuring devices. The effects of chemicals on various plastics are reviewed.

Coatings

GEL LACQUERS PROVIDE NEW COATING METHOD. C. J. Malm and H. L. Smith, Jr. Chemical Industries *58*, 776-7 (May 1946). Gelation of a lacquer at a temperature intermediate between dipping and room temperatures to give a heavy uniform coating is the basic characteristic of a new application method. Using cellulose acetate butyrate in a mixture of solvents blended to give the desired viscosity and gel point, it is possible to produce hard, tough protective coatings, on articles which lend themselves to dipping, more quickly and with a coat much thicker than can be obtained with ordinary lacquers. The coating thus obtained is in reality a plastic veneer. A wooden, metal or paper article so coated looks and feels like solid plastic; surface imperfections of the core material are effectively hidden. Moreover, it gives a decorative finish to articles molded from plastic scrap of assorted colors or from low-pressure laminates. The resulting objects are comparable to those made by injection molding of a thermoplastic material around a core, but the new method is more economical of material, requiring only about a third as much, and eliminates the necessity for the use of molds.

MECHANISM OF SOLVENT ACTION. A. K. Doolittle. Ind. Eng. Chem. *38*, 535-40 (May 1946). Temperature dependence of solvent ability in homologous series of solvents is influenced by the molecular weight of the solvent. In general, the members of low molecular weight become better solvents with rising temperature and the members of high molecular weight become better solvents with falling temperature. The shape of solvent molecules influences temperature dependence of solvent ability more than its weight. In general, compact molecules have a positive temperature coefficient of solvent ability, whereas extended molecules have a negative temperature coefficient of solvent ability. Branched molecules are likely to exhibit greater decrease of solvent ability with rise in temperature than their linear isomers, and the amount of such inversion is more pronounced, the greater the linear extension of the branches. In linear solvent molecules containing multiple active groups, the inversion is greater, the farther removed the active groups are from the ends of the molecule. Gels involving organic solvents and macromolecular solutes may be made which may be liquefied by heating or by cooling, depending on the choice of solvent. Solvents having a positive temperature coefficient of solvent ability may ordinarily be used to produce gels that liquefy on heating. Gels that liquefy on cooling may often be made from solvents that show a considerable negative temperature coefficient of solvent ability. Linear solvent molecules are generally more effective for use in promoting an abrupt sol-gel transformation than are branched molecules although the latter may often exhibit a greater negative temperature coefficient of solvent ability. Gels that liquefy on cooling may be made of systems of two or more components and may employ resinous substances of quite different character although the time rate of the sol-gel transformation may vary with different resinous substances.

NITROCELLULOSE LACQUERS. W. Koch, H. C. Phillips and R. Wint. Ind. Eng. Chem. *38*, 518-21 (May 1946). Cellulose nitrate of RS type, having viscosities of $^1/_2$- and $^1/_4$-sec., 30-35 and 18-25 cp., were evaluated in experimental lacquer compositions in direct comparison with three representative commercial furniture lacquers. Nonvolatile content at a spraying viscosity of 80 cp., temperature-change resistance, print resistance, Sward hardness, sandability and water-spot resistance data were obtained. It was demonstrated that furniture lacquers, equivalent in performance to the best commercial compositions, with materially increased nonvolatile content, can be formulated with cellulose nitrate lower in viscosity than RS $^1/_2$-sec.; the minimum practical level of cellulose nitrate viscosity appeared to be 30-35 cp. in the kind of composition studied. Proper selection of resin and plasticizer was important in formulating high quality lacquers based on RS cellulose nitrate $^1/_4$-sec. and 30-35 centipoise.

DECORATIVE FINISHES. British Plastics *18*, 183-4 (April 1946). A decorative finish is made by spraying natural or synthetic fibers onto a surface which is covered with a wet organic coating. After drying, the coating is brushed to remove excess fibers. A special spray gun for applying the fibers has been developed.

4

Technical Briefs

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

OPTICAL METHODS IN ELECTROPHORESIS. L. G. Longsworth. Ind. Eng. Chem., Anal. Ed. *18*, 219–29 (Apr. 1946). The optical equipment developed at the Rockefeller Institute for the quantitative study of refractive index gradients in solution is described, together with suggestions for its installation and adjustment. This equipment, which is based on the Foucault-Toepler Schlieren method, also incorporates a scanning modification and the cylindrical lens arrangement of Philpot and Svensson. The chief use of the apparatus is to record moving boundary patterns in electrophoretic analysis of proteins by the Tiselius method. The precise measurement of refractive index differences in aqueous solutions represents a recent application of the apparatus.

RUBBER AND PLASTICS AS MATERIALS OF CHEMICAL PLANT CONSTRUCTION. M. G. Fontana. Chem. & Met. Eng. *53*, 102–5, 109 (Apr. 1946). Properties of the various types of synthetic rubbers and plastics are reviewed with respect to their use in chemical plant equipment. Chemical resistance is a major problem. Some typical applications are described. Thirteen references.

Chemistry

A LIGHT SCATTERING INVESTIGATION OF CELLULOSE ACETATE. R. S. Stein and P. Doty. J. Am. Chem. Soc. *68*, 159–67 (Feb. 1946). The complications in the light-scattering method of molecular weight determination when the molecules are large enough to give a dissymetrical angular intensity distribution are discussed. An instrument for the absolute measurement of turbidity is described together with the method of calibration. An instrument for the measurement of the angular distribution of intensity of scattered light is described. Measurements of turbidity, dissymmetry, refractive index increment and depolarization were made on solutions of four cellulose acetate fractions whose molecular weight had been otherwise determined. The molecular weights calculated from the optical measurements agreed within 8 percent of those measured by other means. The empirical constant which characterizes the deviation from Van't Hoff law behavior was found to be 0.45 ± 0.01 by light scattering measurements as compared with 0.43 ± 0.005 based on osmotic pressure measurements for the cellulose acetate-acetone system. The angular variation of intensity is found to be in agreement with the theoretical prediction. The comparison of the measured dissymmetry with that predicted theoretically for a rod-shaped or random coil molecule indicates that the cellulose acetate molecule in acetone solution is rather extended up to a molecular weight of about 80,000. At higher molecular weights the molecule may coil back on itself to a degree that increases rapidly with molecular weight.

SOME FACTORS AFFECTING COPOLYMERIZATION. C. C. Price. J. Polymer Sci. *1*, 83–9 (March 1946). The available data on copolymerization indicates that the polarity of monomer double bonds is one important factor regulating the ease of copolymerization. There is evidently a marked electrical factor favoring copolymerization for those pairs of monomers in which one monomer has an electron-rich and the other has an electron-poor double bond. The importance of radical stability and steric effects is considered.

HETEROGENEOUS ACID AND ACID-SALT HYDROLYSIS OF SECONDARY CELLULOSE ACETATE. R. N. Haward and T. White. J. Soc. Chem. Ind. *65*, 63–4 (Feb. 1946). The heterogeneous hydrolysis of secondary cellulose acetate was investigated in aqueous solutions of acids and acid salt mixtures. A marked anionic effect occurs with neutral salts which increase the rate of reaction but the lyotropic series is arranged in the opposite order to that reported elsewhere in the case of homogeneous hydrolysis.

β-ALKOXYPROPIONATES. ADDITION OF ALCOHOLS TO THE OLEFINIC LINKAGE OF ALKYL ACRYLATES. C. E. Rehberg, M. A. Dixon and C. H. Fisher. J. Am. Chem. Soc. *68*, 544–6 (Apr. 1946). Primary, secondary, branched-chain and unsaturated alcohols added satisfactorily to the olefinic linkages of acrylic esters, producing β-alkoxypropionates; *t*-butyl alcohol did not add. By simultaneous addition and alcoholysis, methyl acrylate was converted into ethyl ethoxypropionate, propyl propoxypropionate, *n*-butyl butoxypropionate, ethylbutyl ethylbutoxypropionate and allyl β-alkoxypropionate. The higher alkyl β-methoxypropionates were prepared in high yields by alcoholysis of methyl methoxypropionate. Alkyl β-allyloxypropionate polymerized readily, yielding a hard, colorless, transparent and insoluble resin. The tendency of allyl alkyloxypropionate to form cross-linked methyl acrylate copolymers was approximately equal to that of crotyl acrylate.

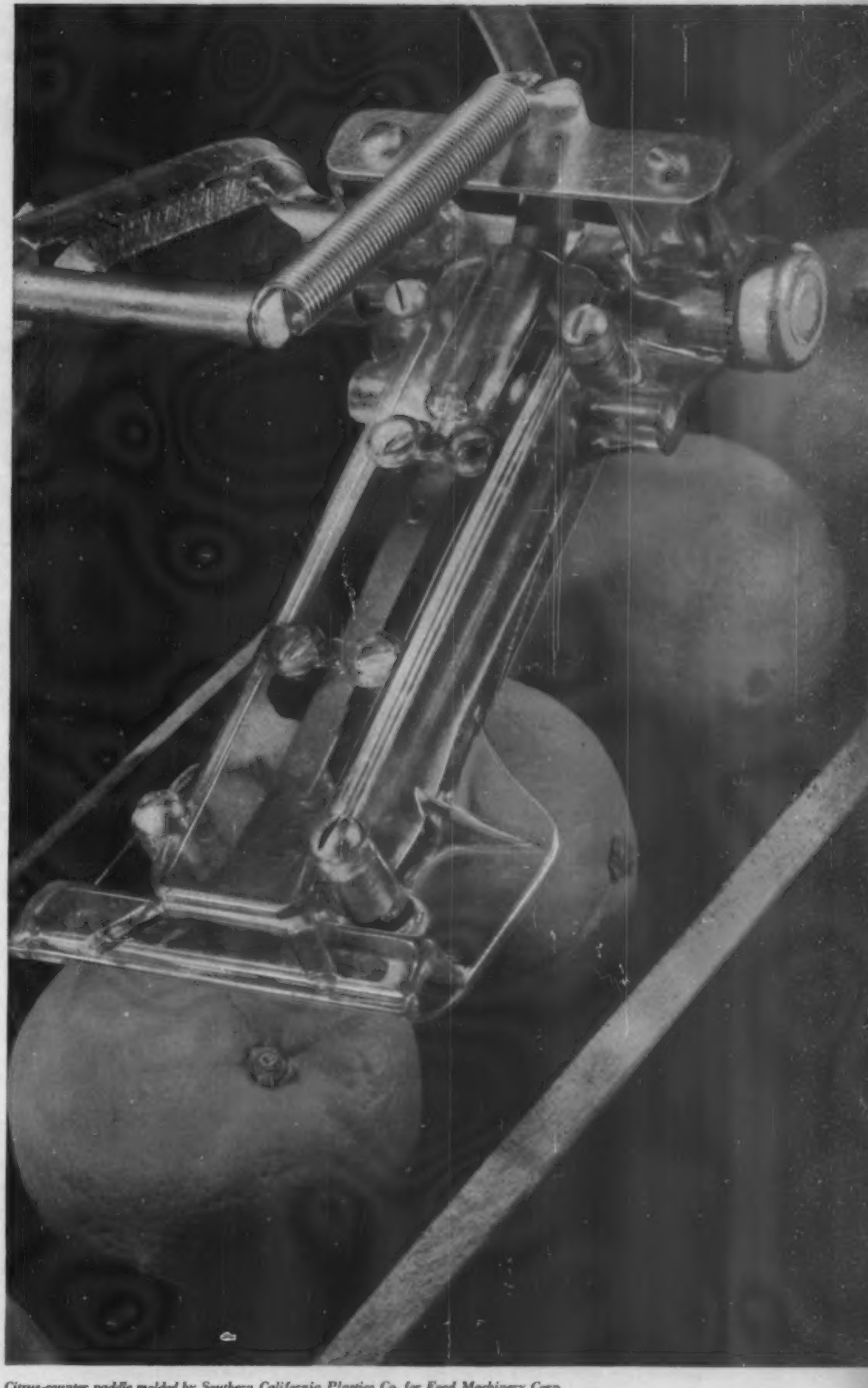
FATTY ACID SOAPS IN EMULSION POLYMERIZATION. L. W. Rainard. India Rubber World *114*, 67–9 (Apr. 1946). A correlation was observed between oxidation potential and polymerization rate of a definite emulsion polymerization system. In butadiene systems the polymerization rates are not proportional to the square root of the catalyst concentration and generally exhibit maxima after which increased catalyst concentrations decrease the rate of polymerization. The role of fatty acid soaps in emulsion polymerization is described, tentatively, partly on the basis of the chemical interaction of the soap and of the peroxides.

Properties

CEMENTING PHENOLIC LAMINATES. J. Delmonte. Plastics (Chicago) *4*, 62, 64, 66, 92–3 (Apr. 1946). The bonding of phenolic laminates with furane resin adhesives was investigated. Strong bonds are obtained with smooth surfaces. These bonds did not deteriorate on aging although a temperature of 200° F. was maintained for a year.

DIFFUSION OF VAPORS THROUGH POLYMERS. P. Doty. J. Chem. Phys. *14*, 244–51 (Apr. 1946). The rate of permeation of a gas through a polymer as a function of temperature may be represented as $P = P_0 e^{-E/RT}$. All available data on the permeability of gases through polymers show that for a given gas there is a linear relation between log P_0 and E (the energy of activation for permeation). The effect of plasticization on permeation of water vapor was studied experimentally and it is shown that lowering of the heat of solution is the predominant effect. From the data the entropy of solution may be calculated and interpreted as showing that water molecules dissolved in the unplasticized polymer exhibit much less freedom than when they are dissolved in plasticized polymer. Other calculations show that a large number of degrees of freedom are simultaneously operative in the process of the diffusion of a gas molecule through a polymer. *(Please turn to next page)*

Tenite Counts



Citrus-counter paddle molded by Southern California Plastics Co. for Food Machinery Corp.

Transparent Tenite is molded into paddles for electric counters which record the number of pieces of citrus fruit conveyed along a moving belt. One of the toughest plastics made, Tenite easily withstands the repeated impact it receives from the fast-traveling fruit; and because of its exceptionally light weight, only slight pressure is required to prevent the paddle from bouncing after it is struck—thus insuring accurate counting and recording. The paddle weighs only 2½ ounces complete with enclosed electrical apparatus.

Tenite is used for many other products which require superior strength and durability — among them, saw handles, steering wheels, trim for terrazzo flooring, and motorcycle starter pedals. These are molded or extruded of Tenite in a minimum of time and often at reduced cost to the manufacturer.

For complete information about the properties and uses of Tenite, write to TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

TENITE AN EASTMAN PLASTIC

Testing

METHODS OF MEASURING CONDUCTIVITY OF ELECTRICALLY CONDUCTIVE RUBBER. R. G. Newton. J. Rubber Research *15*, 35–60 (Mar. 1946). The measurement of conductivity of electrically conductive rubbers is not a simple matter, because the application of a mercury electrode to the surface of the sample does not produce a good contact. The resistance so measured may bear little or no relation to the true resistance of sample, because the resistance at the interface may be many times greater than resistance of the rubber itself. Various types of electrode systems used by other workers for measuring the direct-current conductivity of dielectrics are discussed, and the majority of them are shown not to be applicable to the testing of electrically conductive rubber. The general question of contact resistance is discussed and methods are described by means of which the contact resistance can be determined independently of the resistance of the sample. Conversely, it is shown how the true resistivity of the sample can be measured, independently of the method of making contact; this method requires special apparatus for its operation, which may not always be convenient for routine application. Convenient circuits are described by means of which the approximate resistance of electrically conductive rubber samples can be measured, using only inexpensive types of instruments which are to be found in works laboratories.

WATER-VAPOR PERMEABILITY TESTER. F. T. Carson and V. Worthington. Paper Ind. & Paper World *27*, 1799–1805, 1816 (Mar. 1946). A conditioning and testing cabinet is described in which the hygrometric conditions are maintained by equilibrium with a saturated solution of an appropriate salt. The temperature of this solution and of the testing chamber is held constant by means of an envelope of moving air that completely surrounds the testing chamber, an open-coil heater and a thermoregulator being used to control the temperature of this air bath. Devices for supporting and weighing the permeability cells in the cabinet, without disturbing the hygrometric conditions, are explained in detail. The cells, hung by hooks from a rotary suspension disk, can be suspended one at a time from a weighing rod attached to a balance. Interlocking mechanisms for selecting and picking up the cells facilitate the weighing and protect the apparatus and the permeability cells from accidental injury. A method and apparatus for mounting the specimens in the permeability cells are described. Materials covering a large permeability range can be accommodated. A number of suggestions are made for speeding the testing of good moisture barriers.

A FAST STRESS-STRAIN MACHINE. S. L. Dart, R. L. Anthony and P. E. Wack. Rev. Sci. Instruments *17*, 106–8 (March 1946). A fast stress-strain machine for the study and testing of rubberlike materials is described. The machine is of simple design and can be operated at speeds up to 200 percent extension per second without serious error due to inertial effects. The complete stress-strain loop is recorded automatically. The reproducibility of the data obtained with this machine for a number of test specimens cut from the same tensile sheet is of the order of one percent.

DETERMINING THE MOISTURE EQUILIBRIUM CURVES OF HYGROSCOPIC MATERIALS. W. A. Wink. Ind. Eng. Chem., Anal. Ed. *18*, 251–2 (Apr. 1946). A method for determining the equilibrium moisture content-temperature curves of hygroscopic materials is described.

IMPROVED GUIDES FOR POSITIONING OF IMPACT SPECIMENS. J. R. Speer. A.S.T.M. Bull. No. 139, 46–7 (Mar. 1946). New guides for positioning specimens in an impact testing machine are described.

Synthetic rubber

EFFECTS OF MOLECULAR STRUCTURE ON PHYSICAL PROPERTIES OF BUTYL RUBBER. P. J. Flory. Ind. Eng. Chem. *38*, 417–36 (Apr. 1946). An investigation was undertaken in an attempt to establish the fundamental connections which must exist between physical properties of a typical vulcanized rubberlike polymer and its chemical structure. The structural variables to be considered are the molecular weight of the "primary molecules" entering the vulcanizate, their molecular weight distribution, and concentration (or frequency) of cross linkages introduced during vulcanization. The molecular weights of the Butyl rubbers were determined by previously established procedures; effects of molecular weight heterogeneity were suppressed by careful fractionation from very dilute solution. An indirect method, based on the theory of gelation and on the observation of critical molecular "vulcanizates" formed when the cross-linking capacity is fixed, was employed to determine the frequency of occurrence of cross-linked units—a quantity not hitherto evaluated in a vulcanized rubber. In representative pure-gum vulcanizates of Butyl, the molecular weight per cross-linked unit ranges from about 35,000 to 20,000, depending (inversely) on the diolefin content of the raw rubber. Micro compounding and testing procedures were devised for evaluating the necessarily small samples obtained in fractionation. Complete evaluation of tensile strength, stress-strain characteristics, swelling in solvents, and creep rate can be obtained with as little as 3 grams of rubber. Results are no less reproducible than those obtained with conventional procedures requiring 50 grams or more. A number of relationships between vulcanizate structure and physical properties were established. The feasibility of a rational approach to the interpretation of properties of rubber vulcanizates in terms of molecular structure was demonstrated in this article.

VULCANIZATION OF RUBBER WITH SYNTHETIC RESINS. A. J. Wildschut. Rubber Chem. and Technology *19*, 86–99 (Jan. 1946). Natural and synthetic rubber can be vulcanized with several vulcanizing agents other than sulfur, though sulfur and sulfur compounds are the only agents of practical value. A combination of rubber and synthetic resin can be successful only when chemical bonds are formed. This is the case with certain synthetic resins; natural and synthetic rubber can be vulcanized with these resins, without adding any other agent or filler, in much the same way as with sulfur. An example of these resins is the resol from pentaphene (*p-tert*-amylphenol) and formaldehyde. Data are given for the technical properties of rubber-resin vulcanizates. Catalysis or a similar effect is produced by magnesium oxide, which increases the tensile strength, while hexamethylene-tetramine prevents the reaction. Balata can be vulcanized with the same synthetic resins as rubber; with gutta-percha the effect of heating with rubber-vulcanizing resins is the same as with sulfur. The probable configuration of the rubber-resin vulcanizates consists of two systems of entangled thread-molecules, which are interlinked at points by primary valence bonds.

RUBBER DEVELOPMENTS IN 1945. A. E. Boss and R. KixMiller. Chem. and Eng. News *24*, 336–8 (Feb. 10, 1946). Developments in rubber during 1945 are discussed. The topics considered include quality of GR-S, new synthetic types, synthetic latex, future research and development, German technical information and outlook for the future.

SHELLAC AS AN INGREDIENT OF RUBBER COMPOSITIONS. J. R. Scott. Rubber Chem. & Tech. *19*, 125–50 (Jan. 1946). J. Sci. Ind. Research *3*, 345–53 (Feb. 1945) and 407–17 (Mar. 1945). The incorporation of shellac into vulcanized rubber compositions was studied and effects on the products investigated.

NEW SYNTHETIC RUBBERS BASED ON METHYLPENTADIENE. F. M. McMillan, E. T. Bishop, K. E. Marple and T. W. Evans. India Rubber World *113*, 663–9, 714 (Feb. 1946). Synthetic rubbers made from methylpentadiene are described. The synthesis, properties, compounding, processing, vulcanization and applications are discussed.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each.

LIGHT POLARIZERS. C. E. Barnes (to Polaroid Corp.). U. S. 2,397,231, March 26. A sheet of light polarizing plastic material is coated with a thin layer of a light-transmitting, adhesive material after which a coating of light transmitting resin is polymerized *in situ* around sheet.

RESIN. W. H. Butler (to Bakelite Corp.). U. S. 2,397,240, March 26. An ester resin comprising the reaction product of a cyclopentadiene adduct of maleic anhydride with a polyhydric alcohol and a fatty acid of drying or semi-drying oils, their monoglycerides or their triglycerides.

COATING. L. W. Chubb, Jr., and C. J. T. Young (to Polaroid Corp.). U. S. 2,397,242, March 26. A light polarizing device comprising a light transmitting supporting element, a polarizing layer comprising an extremely thin film of oriented molecules, a protective layer of urea-formaldehyde or melamine-formaldehyde, a layer of non-oxidizing and non-setting alkyd resin, and a final layer of hard, abrasion-resistant plastic.

OPTHALMIC DEVICE. D. P. Cooper, Jr. (to Polaroid Corp.). U. S. 2,397,-243, March 26. An ophthalmic device comprising a frame and lenses of light-polarizing plastic.

POLYETHYLENE. W. E. Hanford and J. R. Roland (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,397,260, March 26. Copolymers of ethylene and vinylidene chloride are prepared by heating in the presence of a per-oxy compound at 40 to 350° C. and 50 to 1500 atm.

LIGHT POLARIZING IMAGE. E. H. Land (to Polaroid Corp.). U. S. 2,397,-276, March 26. Transparent plastic material having uniformly oriented long chain molecules, predetermined portions being dyed with a dye which renders said portions negatively dichroic, the remainder being positively dichroic, forming thereby, in polarized light, two separate images.

METHACRYLIC ESTERS. B. E. Ostberg (to Polaroid Corp.). U. S. 2,397,-287, March 26. Triethoxy silicol methacrylate and polymers thereof.

PLASTIC. W. W. Koch (to Hercules Powder Co.). U. S. 2,397,320, March 26. A plastic nonflammable composition comprising ethyl cellulose, a plasticizer, and a heavy metal oxalate.

MOLDING MATERIAL. J. J. Trefz and L. S. Shoberg (to Julius F. Trefz). U. S. 2,397,323, March 26. A synthetic resin is prepared by digesting a furfural-bearing material with steam in the presence of acid and reacting with phenol in alkaline medium.

FILAMENTS. H. Cowling (to American Viscose Corp.). U. S. 2,397,338, March 26. In the production of artificial filaments a solution of viscose containing an ethylene oxide polymer is extruded into a precipitating bath.

RESIN. J. Dahle (to Pro-phy-lac-tic Brush Co.). U. S. 2,397,340, March 26. A reaction bath is prepared comprising an acetalization catalyst and isopropyl-formal and a sheet of polyvinyl alcohol is subjected to said bath so as to water insolubilize the sheet.

RESIN. H. S. Rothrock and W. H. Wood (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,397,372, March 26. A vulcanizable composition comprising polymeric, conjugated diene elastomer and a monomeric ester of β-furylacrylic acid.

RESIN. D. E. Badertscher and R. B. Bishop (to Socony Vacuum Oil Co., Inc.). U. S. 2,397,398, March 26. A resinous product prepared by condensing formaldehyde and a petroleum fraction rich in aromatic hydrocarbons in the presence of an acid catalyst.

CELLULOSE DERIVATIVE. J. B. Rust and W. H. Van Delden (to Montclair Research Corp.). U. S. 2,397,437, March 26. A formaldehyde-cellulose compound soluble in alkali solutions and consisting in coagulated reaction product of an alkali-cellulose and formaldehyde.

FIBER TREATMENT. E. White and C. A. Smucker (to Owens-Corning Fiberglas Corp.). U. S. 2,397,453, March 26. A mineral fiber treating and bonding material comprising a stable aqueous emulsion of partially polymerized furfuryl alcohol and gelatin.

THERMOPLASTICS. H. L. Cox (to Carbide and Carbon Chemicals Corp.). U. S. 2,397,471, April 2. A thermoplastic article containing a metallic insert is prepared by hot-forming the article, forcing the insert into the article when the latter is in the cooled and solid state, then inductively heating the metal thereby releasing the strains in the plastic.

RESINS. W. O. Kenyon and W. F. Fowler, Jr. (to Eastman Kodak Co.). U. S. 2,397,548, April 2. A resin prepared by partially deesterifying in the presence of an acid and a carbonyl compound, a copolymer of a monovinyl ester of a saturated monocarboxylic acid with a mono-2-chloroallyl ester of a saturated monocarboxylic acid.

WIRE COATINGS. A. O. Blades (to General Cable Corp.). U. S. 2,397,592, April 2. An insulating and protective coating for conductors comprising a vinyl chloride-acetate copolymer plasticized with a mixture of hydrogenated methyl abietate, acetylated castor oil, butoxy ethyl stearate and butyl acetyl ricinoleate.

RESIN. H. L. Gerhart (to Pittsburgh Plate Glass Co.). U. S. 2,397,600 April 2. A resin is prepared by heating a mixture of dicyclopentadiene and an unsaturated glyceride oil to a temperature of 200 to 260° C. for 1 to 10 hours.

RESIN. H. L. Gerhart and L. M. Adams (to Pittsburgh Plate Glass Co.). U. S. 2,397,601, April 2. A resinous product is prepared by heating in the absence of catalysts in a closed system, a mixture of polymers of cyclopentadiene and an unsaturated glyceride oil to a temperature above 160° C. until a copolymer soluble in petroleum naphtha is formed.

ESTER POLYMERS. W. F. Gresham (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,397,602, April 2. Polymers are prepared by heating between 25 and 300° C. under alcoholysis conditions and in the presence of a non-acid alcoholysis catalyst, an organic carbocylic acid ester and a compound such as di-(beta-hydroxyethyl) formal, di-(betahydroxyethoxy) methoxyethyl formal, di(beta-hydroxyethoxy methoxy) ethane, hydroxyethyl methoxyethyl formal, di-(beta-hydroxyethyl) acetal, and a polymeric product resulting from heating 1,3-dioxolane in contact with an acidic catalyst.

SAFETY GLASS. W. H. Lycan (to Pittsburgh Plate Glass Co.). U. S. 2,397,612, April 2. A plastic interlayer for safety glass comprising a flexible sheet of polyvinyl acetal resin plasticized with an ester of a dihydroxy ethyl ether alcohol containing 2 to 3 ethyl groups and a mixture of branched chain acids obtained by air oxidation of an open-chain petroleum hydrocarbon.

PRINTING PLATE. W. G. Mullen (to Lithomat Corp.). U. S. 2,397,616, April 2. An intaglio printing plate comprising a waterproof base and a casein coating, selected areas of said coating being

water resistant and covered with a water insoluble grease-receptive polyvinyl alcohol, the uncovered portions being water-sorptive and grease-repellent and disposed at a level above that of the grease receptive areas.

ADHESIVES. O. H. Smith (to United States Rubber Co.). U. S. 2,397,627, April 2. Rubber is adhesively bonded to other surfaces by means of heat and pressure and an intermediately disposed layer comprising a rubber derivative obtained by the depolymerizing action of heat and oxygen on dissolved raw rubber in the presence of free sulfur and a vulcanization accelerator, in combination with a partially reacted soluble phenol-aldehyde resin such as resorcinol crotonaldehyde, resorcinol-furfural, geraniol-resorcinol-formaldehyde, or phenol-furfural-formaldehyde in which the amount of aldehyde reacted with the phenol is less than equimolecular.

COPOLYMERS. O. W. Cass (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,397,724, April 2. Resinous materials are prepared by copolymerizing a monomeric mixture of vinyl chloride and trichloroethylene.

ORGANO-SILOXANES. W. H. Daudt (to Corning Glass Works). U. S. 2,397,-727, April 2. Synthetic compositions are prepared by mixing two organo-siloxanes which are immiscible at room temperature, blowing air through the mixture while heating to reaction temperatures.

BABY PANTS. L. H. Rand (to Rand Rubber Co.). U. S. 2,397,751, April 2. Baby pants including a body portion made of a compounded film material including a vinyl resin, a plasticizer and silica gel.

ORNAMENT. J. J. Hagerty. U. S. 2,397,856, April 2. A decorative button composed of plastic material.

ORGANO-SILOXANES. E. L. Warrick (to Corning Glass Works). U. S. 2,397,895. April 2. New compositions are prepared by intercondensing a partially condensed methyl siloxane with trimethylethoxy silane in the presence of water.

PLANKING. A. A. Glidden and W. R. Hickler (to B. F. Goodrich Co.). U. S. 2,397,936, April 9. Synthetic lumber comprising a dense heat-molded composition of heat-set resin and fibrous material interspersed therethrough.

THERMOPLASTIC. E. F. Brookman and L. W. Smith (to Imperial Chemical Industries, Ltd.). U. S. 2,397,942, April 9. New compositions comprising a polyvinyl halide, an aromatic triester of phosphoric acid, a minor proportion of a glycol ether phthalate and a hard thermoplastic.

COATINGS. M. Salo (to Eastman Kodak Co.). U. S. 2,398,042, April 9. A protective coating is formed on a sheet of paper by depositing a molten composition comprising ethyl cellulose and a plasticizer.

COATING. G. H. Young (to Stoner-Mudge, Inc.). U. S. 2,398,069, April 9. An antifouling composition comprising a toxic component comprising the reaction product of a bifunctional phenol, a saturated lower aliphatic aldehyde, and an unsaturated aldehyde and a permable organic film-forming vehicle.

HANDBAG. J. Samuelson. U. S. 2,398,118, April 9. A handbag containing plastic parts.

ABRASIVE. R. W. Hackett (to Abrasive Products, Inc.). U. S. 2,398,224, April 9. A flexible abrasive sheet comprising a flexible backing, abrasive grit affixed to said backing by a flexible tough non-brittle coat of glue, and a heat-hardened coat of a dried aqueous solution of a phenol-aldehyde condensate.

RESIN. F. A. Hessel and J. B. Rust (to Ellis-Foster Co.). U. S. 2,398,307, April 9. A composition comprising a nitrogenous body such as a water-soluble protein and, as a hardening agent under the influence of heat, a water-soluble resin prepared by condensing acetone with formaldehyde in the presence of borax.

INJECTION MOLDING. H. F. MacMillin and G. A. Waldie (to Hydraulic Development Corp., Inc.). U. S. 2,398,-318, April 9. An injection machine for heating and molding plastic material.

RESINS. J. B. Rust and F. A. Hessel (to Montclair Research Corp.). U. S. 2,398,331, April 9. A heat-curable composition comprising a water-soluble polyhydric phenol having the hydroxyl groups attached to the same nucleus and a water-soluble hard acetone-formaldehyde resin prepared in the presence of borax, and a curing catalyst comprising the ammonium salt of a strong acid.

VINYL ESTERS. H. M. Collins and M. Kiar (to Shawinigan Chemicals, Ltd.). U. S. 2,398,344, April 16. A stable aqueous emulsion of polyvinyl acetate is prepared by emulsifying in water, vinyl acetate in the presence of a partially hydrolyzed polyvinyl acetate, heating and stirring in the presence of a peroxide catalyst for 50 to 300 min. under reflux at a temperature of 66 to 90° C.

ELASTOMER. F. C. Atwood and H. A. Hill (to National Dairy Products Corp.). U. S. 2,398,350, April 16. An alkyl acrylate polymer is formed into an elastic substance by milling with hydrated lime, molding and heating.

RESIN. R. S. Daniels (to Bakelite Corp.). U. S. 2,398,361, April 16. A resinous product of phenol and formaldehyde and a hardening agent comprising an alkyl ammonium sulfate.

LAMINATED STOCK. A. J. Norton (to Pennsylvania Coal Products Co.). U. S. 2,398,388, April 16. A laminated stock is prepared by curing under pressure at a temperature of 100 to 110° C. a plurality of assembled fibrous laminae impregnated with a resinous reaction product of resorcinol and formaldehyde in the presence of a mild alkaline catalyst.

INLAYING. T. Wainman (to Plastic Inlays, Inc.). U. S. 2,398,482, April 16. A method of inlaying comprising applying pressure to an inlay to force it into engagement with an article, simultaneously heating said inlay during the pressing and subsequently cooling under pressure.

LIGHT POLARIZER. H. G. Rogers (to Polaroid Corp.). U. S. 2,398,506, April 16. A light polarizer comprising a supporting plate and a thin dichroic layer thereon of a linear hydrophilic high polymeric material in which the polymer molecules are substantially oriented.

RESIN. G. Widmer (to Ciba Products Corp.). U. S. 2,398,569, April 16. A hardenable resinous ester of an ether of an aminotriazine-formaldehyde condensate esterified with an esterifying agent comprising a fatty acid containing at least 10 carbon atoms.

WOOD TREATMENT. H. M. Kvalnes (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,398,649, April 16. Dimensional changes in wood induced by moisture are inhibited by impregnating the wood with a solution consisting of water and active methylolureas and thereafter drying the impregnated wood.

ROSIN ESTERS. J. B. Rust (to Montclair Research Corp.). U. S. 2,398,668–9, April 16. Soluble resins are prepared by reacting an abietic acid ester and an allyl ester of a saturated or alpha-unsaturated polycarboxylic acid.

ARTIFICIAL TOOTH. J. A. Saffir (to Dentist's Supply Co.). U. S. 2,398,-671, April 16. An artificial tooth composed of synthetic plastic material.

ORGANO-SILOXANES. R. O. Sauer (to General Electric Co.). U. S. 2,398,672, April 16. Polysiloxanes are prepared from a mixture of halogenosilanes containing at least one monovalent hydrocarbon-substituted halogenosilane by dissolving the mixture in an inert organic solvent such as a liquid hydrocarbon or a liquid ether and hydrolyzing by slowly adding the solution to a two-phase medium comprising water and an aliphatic alcohol.

STYRENE COPOLYMER. R. R. Dreisbach (to Dow Chemical Co.). U. S. 2,398,736, April 16. A solid thermoplastic copolymer of styrene and a nuclear-halogenated styrene.

CELLULOSE ETHERS. W. J. Burke (to E. I. du Pont de Nemours and Co.,

Inc.). U. S. 2,398,767, April 23. Highly substituted organic-solvent-soluble methallyl ethers of cellulose are prepared by reacting alkali cellulose with 20 mols of methallylating agent per mol of cellulose.

ETHYLENE POLYMERS. J. R. Myles and F. S. B. Jones (to Imperial Chemical Industries, Ltd.). U. S. 2,398,-803, April 23. Chlorinated polyethylenes containing 60 to 75 percent by weight of chlorine which are soluble in carbon tetrachloride and have a tensile strength above 400 kg./sq. cm.

PLASTIC TUBES. J. Bailey (to Plax Corp.). U. S. 2,398,876, April 23. A tube of organic plastic material is formed by drawing the material to molecularly orient it, forming the strip into a tube of polygonal cross section by wrapping it spirally around a group of conical rollers, rotating the rollers to cause the tubing to move over them and changing the cross sectional shape of the tubing from polygonal to circular by contracting the tubing as it moves over the rollers and finally cooling.

THERMOPLASTICS. C. C. Clark (to Mathieson Alkali Works, Inc.). U. S. 2,398,882, April 23. A thermoplastic composition comprising polystyrene, polymethyl methacrylate, or cellulose esters plasticized with a mixture of alkyl halophthalates obtained by the esterification of a lower aliphatic alcohol with halogenated phthalic anhydride.

GLASS LAMINATE. J. L. Drake and G. B. Watkins (to Libbey-Owens-Ford Glass Co.). U. S. 2,398,886, April 23. A laminated glass structure comprising two sheets of glass and an interposed layer of thermoplastic adherent thereto and extending beyond the other sheet at one end of the structure.

RESIN. H. L. Gerhart (to Pittsburgh Plate Glass Co.). U. S. 2,398,889, April 23. An artificial resin having drying properties is prepared by maintaining a mixture of a drying glyceride oil, cyclopentadiene and a polymerization catalyst at a temperature above 30° C. until a hydrocarbon-soluble resin is obtained.

MOLDING BASE. I. T. Quarnstrom. U. S. 2,398,893, April 23. A stock plate base for injection plastic molding.

OLEFIN POLYMERS. G. L. Dorough (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,398,926, April 23. Organic polymers are prepared by polymerizing an organic compound containing only one ethylenic double bond by heating at 150 to 400° C. under a pressure of 200 atm. or more in presence of amine oxide catalyst.

ELASTOMERS. C. A. Thomas (to Monsanto Chemical Co.). U. S. 2,398,976, April 23. Elastomeric polymers are prepared by forming an aqueous emulsion of an olefin benzene, a diolefin and butylene or amylene, polymerizing in the presence of an oxygen yielding peroxide catalyst, and precipitating the resin.

POLYSULFIDES. E. S. Blake (to Monsanto Chemical Co.). U. S. 2,398,-998, April 23. A polymeric organic sulfide obtained by the reaction of an alkaline polysulfide and an aliphatic dihalide is softened and plasticized by milling in the presence of small amounts of an organic base and a disulfide of an alkyl ether.

RESINS. B. W. Nordlander (to General Electric Co.). U. S. 2,399,055, April 23. Furfuryl alcohol is resinified in the presence of a chlorinated tricresyl phosphate with chlorinated methyl groups.

SHOE WELT. W. C. Wright (to Wright-Batchelder Corp.). U. S. 2,399,-086, April 23. A shoe welt preformed from stitch-retaining, resilient, waterproof, synthetic plastic material.

MOLDING. H. J. Hart. U. S. 2,399,-117, April 23. Apparatus for molding a cup-shaped article of plastic material.

ROPE. R. F. Warren, Jr. U. S. 2,399,-157, April 23. In a cable or rope, a strand comprising inner and outer metal elements and filler elements of polymerized vinylidene chloride.

KERATIN. G. H. Brother and C. H. Binkley (to U. S. A.). U. S. 2,399,161, April 30. A process for the production of a powdered adhesive comprising reducing keratin in aqueous alkaline sulfide solution, dispersing the product in caustic soda, drying at a temperature under 104° F. and reducing the dried product to a powder.

COATING. H. L. Gerhart (to Pittsburgh Plate Glass Co.). U. S. 2,399,179, April 30. A coating composition is prepared by polymerizing a mixture of an unsaturated glyceride oil and a diene hydrocarbon consisting of 1 to 5 cyclopentane groups per molecule in the presence of a resin soluble therein.

ARMOR PLATE. W. W. Heckert (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,399,184, April 30. A laminated armor plate comprising oriented laminae of synthetic linear superpolymer bonded together with a diphenylolpropane-formaldehyde resin.

PRINTING PLATE. C. Coolidge (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,399,208, April 30. A planographic printing plate comprising a suitable base, a coating of hydrolyzed vinyl acetate, ethylene copolymer and selectively located grease-receptive layers on the surface.

ALKYD RESINS. T. W. Evans and D. E. Adelson (to Shell Development Co.). U. S. 2,399,214, April 30. A convertible alkyd resin is prepared by heating and reacting in an inert atmosphere glycidol allyl ether with a dicarboxylic acid or a dicarboxylic acid anhydride.

POLYMER. R. M. Thomas and F. P. Baldwin (to Jasco, Inc.). U. S. 2,399,262, April 30. A solid plastic hydrocarbon interpolymer which is reactive with sulfur comprising the reaction product of isobutylene and a lower aliphatic diolefin is softened by mixing with an internal-friction reducing compound comprising a derivative of an organic acid having eighteen carbon atoms.

POLYMERS. I. E. Muskat and F. Strain (to Pittsburgh Plate Glass Co.). U. S. 2,399,286, April 30. Polymers of unsaturated esters.

PLASTIC. G. F. Deebel (to Monsanto Chemical Co.). U. S. 2,399,330, April 30. A polyvinyl acetal composition containing 1,4-diphenoxybutene-2 as plasticizer.

TOY. V. D. Desmond (to Pilgrim Plastics, Inc.). U. S. 2,399,333, April 30. A rattle composed of plastic material.

LAMINATING. J. G. Ford (to Westinghouse Electric Corp.). U. S. 2,399,338, April 30. Tubular laminated structures are prepared by coating cellulosic sheet with polyvinyl alcohol, wetting the coating with water to render it tacky, rolling into multi-ply tubular shape, and applying pressure for a period of time, of the order of one second, sufficient to produce high strength permanent bond.

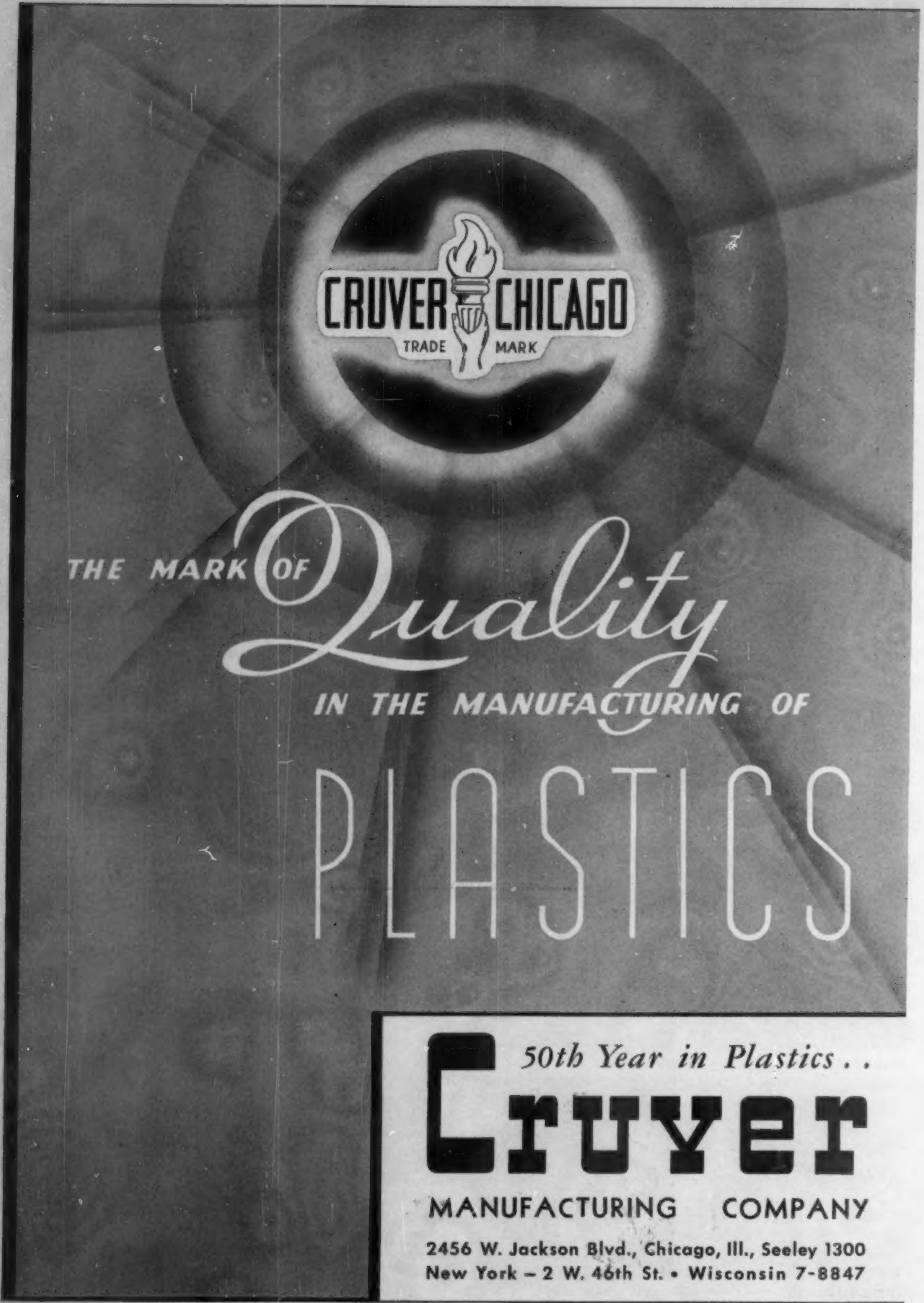
POLYVINYL ALCOHOL. H. M. Sonnichsen and R. F. Gager (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,399,401, April 30. A moldable plasticized composition comprising polyvinyl alcohol, benzaldehyde and glycerol.

COPOLYMERS. F. C. Wagner (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,399,407, April 30. Interpolymers of chloroprene and vinylidene compounds are prepared by emulsion polymerization of the monomers wherein some of the vinylidene monomer remains unreacted, an aliphatic 1,3-butadiene hydrocarbon is then added to take up this excess by interpolymerization, and thereby obviate the homopolymerization of the vinylidene compound.

MOLDING. F. G. Back. U. S. 2,399,422, April 30. A device for cooling fused plastic material after extrusion.

PLASTICIZER. E. S. Yates and R. F. Gager (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,399,456, April 30. Polyvinyl alcohol is plasticized by mixing in the solid state with solid polyoxymethylene glycol.

COATINGS FOR PAPER. D. G. Landes (to American Cyanamid Co.). U. S. 2,399,489, April 30. A coating for paper having a pH value of 4.0 to 7.0 and comprising a mineral pigment, an alkali metal polyphosphate dispersing agent, starch, an acid curing urea-aldehyde or melamine-aldehyde condensation product and an acid catalyst.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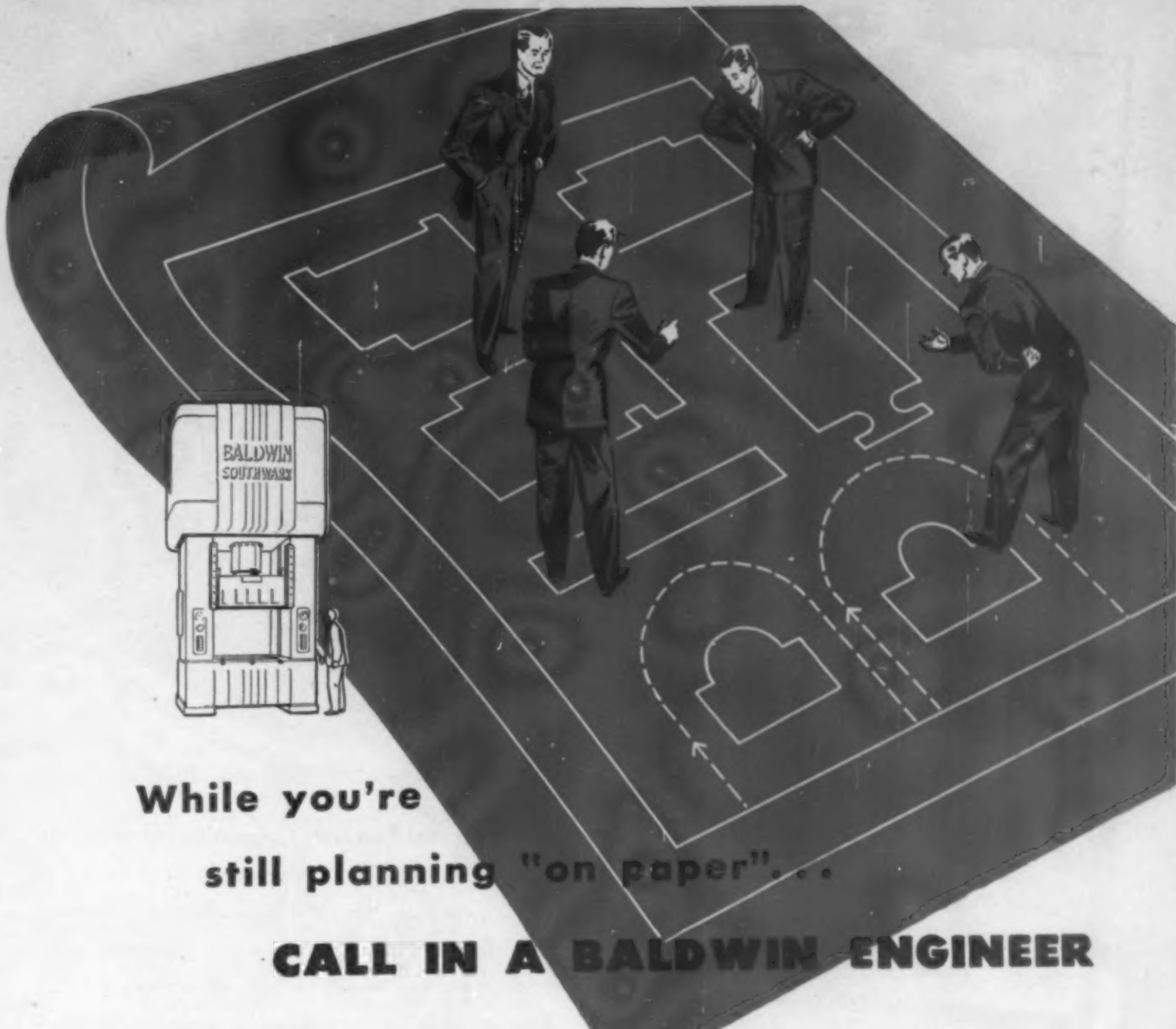

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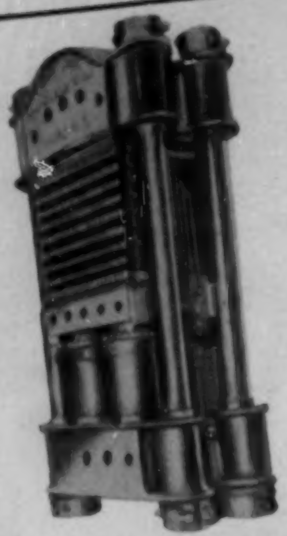
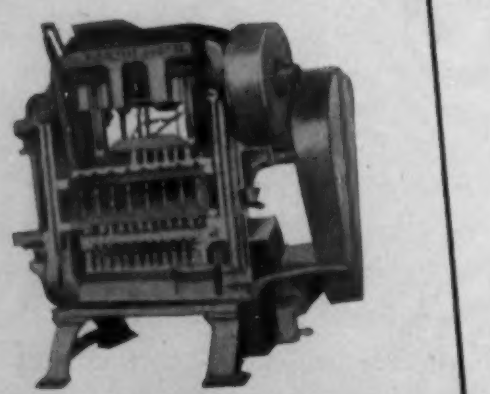


FOR POST FORMING

FOR SHEARING



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• The Hummel-Ross Fibre Corporation announces the manufacture of a new, feather-weight stock known as "XFL", specially designed for saturating and laminating. Because of its light weight, producing extra yardage per ton, and its uniform absorbency, "XFL" is suggested for latex and plastic impregnating. The characteristics of "XFL" make it particularly suitable as a base stock for the manufacture of laminates that are to be used for Post Forming without fracture, for Shearing or Punching. Its extreme softness and flexibility make it ideal for conversion into artificial leathers.

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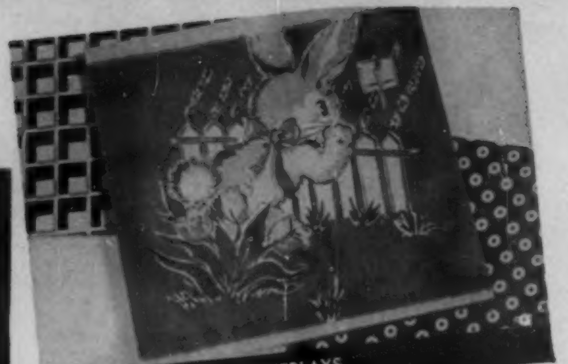

OVERLAYS

GLASS CLOTH LAMINATES

POST FORMING OF LAMINATES

TRAINING at Plastics Industries Technical Institute is timely as well as comprehensive. For example, a small part of the laminating instruction alone includes projects such as the following:

OVERLAYS Decorative possibilities of plastics are now being extended to the plywood field as attractive overlays on finished plywood structures. Students have been trained in these techniques for the past three years.

GLASS CLOTH LAMINATES Part of the curriculum devoted to lamination includes low pressure laminating of glass cloth and other fabrics. Typical shapes produced by students using this method are shown above.

POST FORMING OF LAMINATES A number of the early post forming trials were conducted at Plastics Institute. Today post forming of laminated phenolic stocks is covered in standard projects.

In addition to lamination, other phases of plastics thoroughly covered at Plastics Institute include: Mold design, high-frequency pre-heating and fabrication. Testing methods and molding practices are taught on equipment of the type used in the industry.

Your inquiries regarding Home Training, Study Forums and Resident Technology Courses welcomed. Approved for veterans.

VETERANS as well as CIVILIANS now training with Plastics Institute, upon graduation, are qualified and worthy of your consideration for employment in the various branches of the plastics industry. Write to the nearest branch of Plastics Institute stating your requirements. We will endeavor to select a graduate best qualified to meet your needs.

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Books and Booklets

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery.

Plastics—Scientific and Technological, 2nd edition

by H. Ronald Fleck

Published by Temple Press Ltd., London, and Chemical Publishing Co., Inc., 26 Court St., Brooklyn, 1946.

Price $6.50 — 361 pages

The first edition of this book was reviewed in our April 1945 issue, page 161. New material has been added to the various chapters and the index has been rearranged in this revision.

G. M. K.

The Chemical Constituents of Petroleum

by A. N. Sachanen

Reinhold Publishing Corp., 330 W. 42nd St., New York, 1945

Price, $4.00 — 451 pages

The physical and chemical methods for separation and identification of compounds occurring in petroleum are described and the characteristics of the various components are tabulated. One chapter is devoted to a discussion of the classification and properties of petroleum resins and asphalts. References to original literature are given at the end of each chapter.

G. M. K.

● The first edition of the Uniform Accounting Manual for the plastics industry has been recently published by the Society of the Plastics Industry, Inc., New York 17, N. Y., and has basic information required to insure a sound accounting system. One copy of the Manual is sent free to each member company with additional copies available to members at $2.50 a copy. Supplementary material will be issued from time to time.

● Likening the chemist in his laboratory to the cook in her kitchen, Bakelite Corp., New York 17, N. Y., in its new plastics primer strikes an analogy which will clarify the story of synthetic materials. Entitled "The ABC's of modern plastics," the cleverly illustrated booklet which places its emphasis on the ureas, phenolics, vinyls and polystyrene, gives a complete picture of the manufacture of these synthetic resins and shows how the producer can gear his material to a particular use. In this connection the booklet goes beyond many such publications and discusses plastics not only as molding materials and extrusions, but also as laminating materials, resin glues for wood, bonding materials, coatings, impregnating, sealing and calendering materials, cast resins and fabricated forms.

● Behr-Manning Corp., Troy, N. Y., has just issued a booklet entitled "Coated abrasives in the plastics industry" as the second in a series of supplements to the company's lecture course on coated abrasives. The books were developed for instructors of industrial arts and vocational training, to amplify their knowledge of technical coated abrasives and their uses in industry. Starting with a simplified description of the various plastic materials, the manual presents a comprehensive table of properties and recommended uses, followed by a description of the various sanding practices, machinery and methods in best use throughout industry.

● Milford Rivet & Machine Co., Milford, Conn., has released Catalog No. 45R covering its line of rivets which includes semi-tubular shallow straight and tapered hole rivets, deep straight hole tubular rivets, split rivets and compression rivets.

● Dow Chemical Co., Midland, Mich., has recently published technical data booklets on two new coating materials, Saran F-120—a solvent soluble resin imparting very low moisture vapor transmission—and Saran F-122—a latex forming a continuous film upon air drying.

● Services which Fabri-Form Co., Byesville, Ohio, is prepared to furnish in plastics custom fabrication are described in a leaflet just issued which covers forming, machining and assembly as well as engineering consultation.

● The Merchants Chemical Co., Stamford, Conn., has issued a pamphlet on Cordo-Clad 1060, a plastic base, solvent type, air drying, protective coating. Applied to metal, wood, concrete, etc., by spraying, brushing or dipping, the coating forms a tough resistant film by air drying at room temperature.

● Received from Kearney & Trecker, Milwaukee 14, Wis., are two bulletins, one, No. E-53, a general catalog describing the company's entire line of milling machines, boring and milling machines and their accessories and allied products, and the other, No. CSM-20 on 20, 30 and 50 CSM knee-type milling machines. The latter booklet includes large photographs of many of the machines, illustrates construction features and typical operations, gives plan dimensions and general specifications. All-purpose CMS face milling cutters are also covered in the publication.

● Technical data on FM-I nylon rods is presented in a bulletin prepared by the Polymer Corp., Reading, Pa. Included is an explanation of the chemical structure of nylon, its physical properties, chemical resistance and a listing of suggested uses.

● Cast grid type tank rheostats for electroplating control are described in catalog No. 500 just received from Columbia Electric Mfg. Co., Cleveland 14, Ohio.

● Three new abrasive belt grinders are introduced in Bulletin 310 released by Hammond Machinery Builders, Inc., Kalamazoo 54, Mich. These units include the VH-6 vertical or horizontal abrasive belt grinder, the No. 5 abrasive belt grinder-polisher with horizontal platen and the F-2 flexible belt grinder.

● A leaflet prepared by Ace Abrasive Laboratories, New York 7, N. Y., describes "Star Dust" laboratory-graded pure diamond powders and diamond lapping compound for lapping, polishing and super-finishing of mold surfaces and other similar applications.

● Electric heating units designed and manufactured for all different industrial purposes are described in a leaflet issued by Glenn Electric Heater Co., New York 13, N. Y. Included in the material are photographs and data on bandheaters, cartridge heaters, hot plates, electric ovens, thermostats and other equipment.

● Quimby Pump Div. of H. K. Porter Co., Inc., Pittsburgh 22, Pa., has announced a bulletin covering Streamflow Rotex pumps which are rotary type, positive displacement pumps used for pumping under medium pressure such moderate or low viscosity liquids as cellulose, alkalis, alcohol, acids, dyes, shellac, solvents.

● Riverside & Dan River Cotton Mills, Inc., Danville, Va., has prepared a leaflet dealing with its new method of dyeing fabrics known as Color Bond (resin-pigment dyeing). By this process, a colored coating is formed on individual fibers of the fabric in such a way that the color becomes an integral part of the fiber.

New Machinery and Equipment

● For heat sealing aprons, rain coats, tobacco pouches, hand bags, belts and packages, Electronic Process Corp., Ridgewood, N. J., presents Model No. 101 electronic "weld seal" equipment. Two

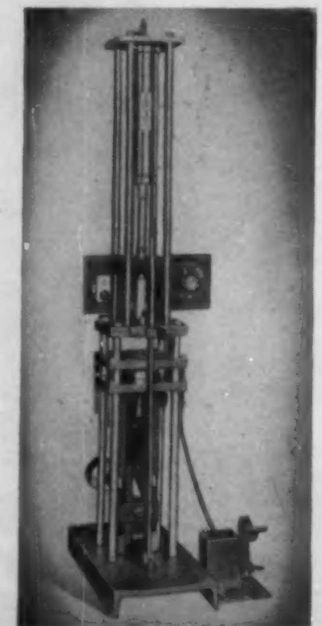
or more thicknesses of 0.004- to 0.062-in. thermoplastic film can be used. Equipment can also be used for bonding precoated calendered or laminated thermoplastic materials with cloth, vinyl coated papers, etc. The equipment includes: Model No. 101 electronic generator housed in fully shielded cabinet with base dimensions of 12 by 17 in. and 18 in. high; Model No. 103 power supply with 110- or 220-v. single phase input and Model No. 104 press and electrode assembly. In the generator, all openings in cabinet are equipped with safety interlock switches, adjustable power coupling inductor and indicating meter.

● A wide range of markings has been made possible with the Safety Utility Marking outfit developed by M. E. Cunningham Co., Pittsburgh, Pa. With the type set up, the unit weighs only 10 to 12 oz. and can be conveniently carried in coat or trouser pocket. It has been adapted to stamping of brand names, lot and serial numbers on etched plates, keys, silverware, tools, tags and machine parts in addition to the stamping of stock numbers on metal bars and sheets. Steel was selected for the holder to eliminate spalling and mushrooming. The wedge grip features and perfect balance assure a firm grip, thus preventing slipping during stamping. This kit is packaged in a wooden container which is furnished with every complete outfit of 2A, 3A and 5A font sizes.

● The Howe Scale Co., Rutland, Vt., has brought out a new tape drive dial scale which features sensitivity and sturdiness, longer life, less service and more accurate weighing, increased readability of dial chart, beams and poises, elimination of the pinion rack or sector in the mechanism, simplicity of tape arrangement and a durable and flexible lever system. It is equipped with the newly designed Howe tape-drive ball-bearing mechanism and has a net weight of 375 pounds.

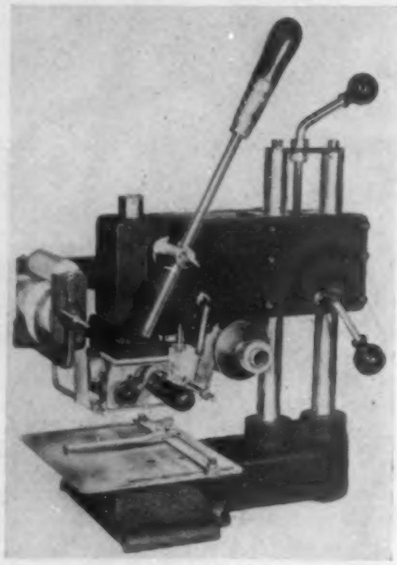
● Nelco Tool Co., Inc., Brooklyn 31, N. Y., has released details on a Carboloy-tipped twist drill that is said to permit faster cutting of plastics, ceramics, cast iron and bronze. In part, the efficiency of the tool is due to the fact that the drills may be ground to suit the material being processed. When properly ground these drills can be used on glass and other very hard materials.

● A new hydraulic foot-operated Hy-Speed plastic injection molding machine for short runs and tests for the proving of color and molds has been announced by Munton Mfg. Co., Franklin Park, Ill. This new machine is designed for use in plants whose output doesn't warrant heavy equipment or where long runs are interspersed with short runs. A large capacity hopper, Robertshaw heat control,



automatic cut-off, Hy-Speed hydraulic ram, foot-power unit, counter balanced open-close lever and toggle lock are standard. Other pertinent specifications include: maximum injection, 3 oz.; clamping pressure, 20,000 lb.; injection pressure, choice of 6000 or 8000 lb.; maximum mold space—width, 9 in.; length, 9 in.; depth, 5 in.; opening, $2^1/_2$ in.; heating element, 110 AC-60 cycles; temperature control, 250 to 550° F.; overall height, approx. 84 in.; floor space, approx. 24 by 48 inches.

● Peerless Roll Leaf Co., Inc., Union City, N. J., has added Model MW to its line of roll leaf hot stamping presses.

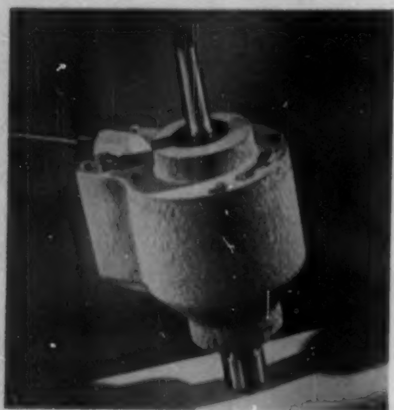


Used for general production work on plastics, cloth, paper, leather, wood, fiber and hard rubber, etc., this new model is simple to operate, yet rugged. Two upright posts instead of the usual single post insure its stability. The handle provides sufficient leverage to obtain as much as 600 lb. of pressure on the surface being stamped. The head, insulated so the press does not get hot after hours of operation, swings up level to allow for quick changing of type or dies. This insulated head uses only one-half the wattage normally required by a non-insulated head. A flat 8 by 10-in. table fitted with gages is interchangeable with a rotary dial table or a swing-out bed. The chase is interchangeable with a 1 by 4-in. die holder. Model MW, 10 in. wide by 17 in. deep by 22 in. high, is wired for 110 AC.

● Thermex Div. of the Girdler Corp., Louisville, Ky., announces a new 18 × 0 portable Thermex Red Head high-frequency dielectric heating unit. The machine has an output of 1 kw. and will

raise the temperature of approx. 1 lb. of average general-purpose material 170° F. in one minute. Only $16^{1}/_{4}$ in. wide, the unit can slip between presses and is completely automatic. The cabinet is $16^{1}/_{4}$ in. wide, $27^{1}/_{4}$ in. deep and $52^{3}/_{4}$ in. high. The $10^{1}/_{4}$ by 13-in. preform tray of aluminum serves as the bottom electrode while the standard upper electrode is $7^{1}/_{2}$ by $7^{1}/_{2}$-in. stainless steel wire mesh. Spacing between the electrodes is adjustable from $^{1}/_{8}$ to $3^{3}/_{8}$ in. The drawer accepts preforms up to $2^{1}/_{2}$ in. in thickness.

● A tap head designed to fit any standard drilling machine has been developed by R. G. Haskins Co., Chicago 12, Ill., and is available in three sizes: No. 1, with either No. 1 or 2 Morse taper shank; No. 2, with



No. 2 or No. 3 Morse taper; and the heavy duty No. 3, which, for extra rigidity, comes with a quill-type adapter only. Any of these can be furnished with a special adapter or quill clamp to meet the combination tapping and external threading spindle. Standard Acorn type dies can be used without any extra adapters or holders. To insure maximum efficiency, individual ground collets are available for each size tap.

● Turner Mfg. Co., Ltd., Wolverhampton, England, has announced a self-contained plastics press with a sealed unit hydraulic system which incorporates a compact high pressure pump. The press, which is supplied complete with thermostatically controlled electric hot plates, dial type thermometers and an interval timing clock, closes at 2 in. per second and opens at $1^{1}/_{2}$ in. per second. Any required pressure between 10 and 50 tons can be obtained. A single lever controls the opening and closing movements of the press. During most of the running time the power consumption of the press is .25 hp. and the maximum power when curing at 50 tons' force is .60 hp. Top and bottom mechanical ejectors can be supplied. Other specifications include: platens, $15^{1}/_{2}$ by $15^{1}/_{2}$ in.; mold opening force, from maximum of 5 tons to minimum of 1 ton; daylight between moving platen and press head, $20^{3}/_{4}$ in.; daylight with hot plates and insulation in place, $14^{1}/_{4}$ in.; motor, $1\ ^{3}/_{4}$ hp.; electric hot plates, 15 by 15 by $2^{1}/_{4}$ in. thick. loading 2 kw. each; stroke of ram, 12 in.; height, 6 ft. 5 in.; size of base, 2 ft. 5 in. wide by 2 ft $1^{1}/_{4}$ in. deep; overall depth including electric motor, 2 ft. $5^{1}/_{4}$ inches.

● Type "F-Z" self-tapping screw for making fastenings to comparatively thin section and bosses in friable and brittle plastics has been developed by Parker-Kalon Corp., New York 14, N. Y. The five cutting flutes of this screw are designed to distribute cutting pressure evenly and prevent localized cracking by permitting chips to drop to the bottom of the hole. The coarse threads are said to eliminate binding by acting as an additional reservoir for displaced material, and also to offer greater resistance to stripping out of the plastic.

● Carman Adams, Detroit 21, Mich., has perfected the Pheco "wrapping by dipping" pot for processing ethyl cellulose protective stripping compound. This unit features constant temperature control which is automatic and adjustable, has no hot spots as a result of the design principle of built-in pots, comes in a range of sizes to fit any specifications, has circulator mixers which provide constant level for mechanical dipping and slow thorough mixing and positive circulation.

● A new air hose coupling, guaranteed leakproof under working pressures up to 1000 lb., has been announced by E. B. Wiggins Oil Tool Co., Los Angeles 23, Calif. In addition to eliminating air leakage, the coupling has features said to increase efficiency wherever air is used in processing. Important is the ease with which gaskets may be changed and the coupling may be connected or disconnected. The unit also handles oxygen, oil, aromatic fuel and kerosene.

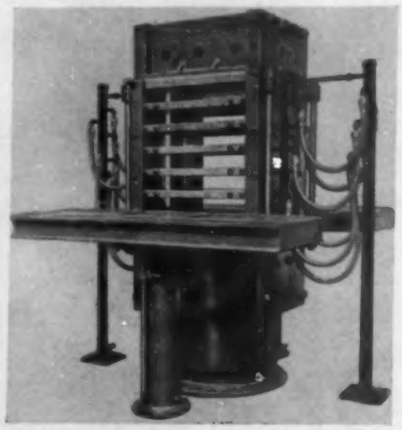
● An all-purpose conveyor-merchandized work table for assembly, inspection and packaging operations is being offered by the Island Equipment Corp., New York 17, N. Y. This "Unitable" as it is called, can be lengthened, shortened or moved with ease and speed. Side leaves can be added quickly because of the table's bolted construction. Small power tools can be mounted on the frame or side leaves, and hung a few inches from the point where needed.

● Tapered cutters which should prove a tremendous time saver for the die maker, have been announced by Detroit Mold Engineering Co., Detroit 12, Mich. These tappers are supplied in six sizes, $^{1}/_{2}$, 1, 2, 3, 5 and 7°, and small end sizes in each case range from $^{1}/_{8}$ to $^{1}/_{2}$ in. with flute lengths from $^{1}/_{2}$ to $3^{1}/_{4}$ in. and are made of fine high-speed steel which is properly heat treated for long life. Draft can be milled directly into a cavity or core without tilting the machine head or altering the set-up.

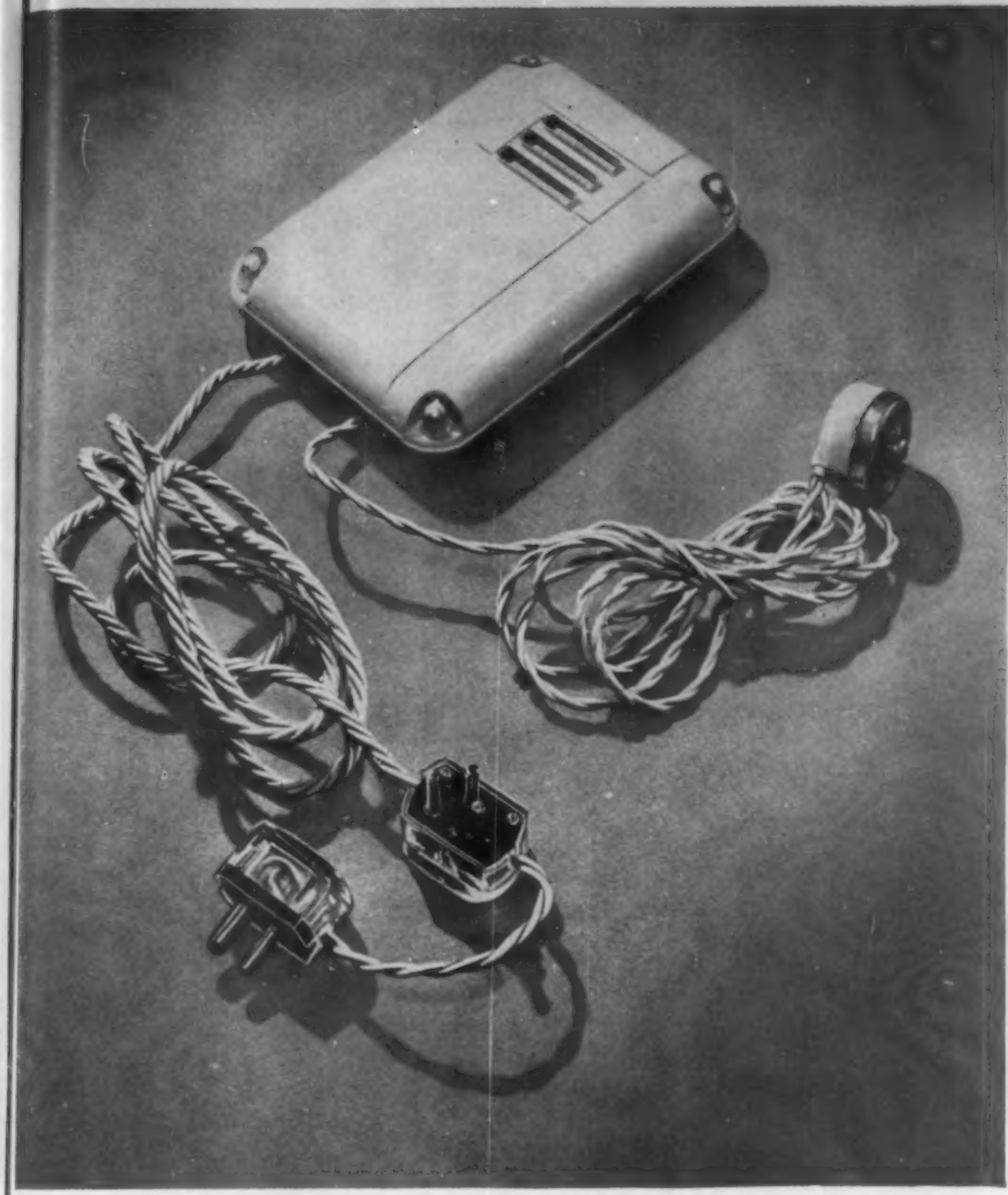
● Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has introduced a new machine, the H-P-M Turbojector, for production molding of both natural and synthetic rubber. The entire cycle of this completely self-contained machine is automatic, the driving mechanism of the injection unit consisting of a 10-hp., 4-speed electric motor and train of gears, directly connected to the injection screw. Maximum nozzle contact pressure during injection is approx. 6000 lb., permitting injection pressures as high as 18,000 p.s.i. on the material to be molded. Experimentally the machine has molded up to 8 lb. of rubber per shot.

● Champ, latest Thermal high frequency heating unit, is offered by W. T. La Rose & Associates, Troy, N. Y. This unit will heat 6 lb. of material to molding temperature in one minute and compounds requiring different time cycles may be heated simultaneously. Preforms or powder are visible at all times. Weighing 500 lb., Champ is 20 in. wide, 30 in. deep and 49 in. high. It has one control operation, dual safety interlock switches and automatic electric time control with intervals from 0 to 3 minutes by seconds. It can be installed by connecting with power line.

● R. D. Wood Co., Philadelphia 5, Pa., has introduced a 50-ton self-contained platen press suited to laboratory and general service. This press can be operated at pressures from 1000 p.s.i. up to



3000 p.s.i. by setting the automatic pressure controller. The 15- by 15- by 2-in. platens, whether steam or electrically heated, are machined parallel within 0.003 in. and provided with smooth tool finish. The intermediate heating platen is suspended by steel hanger rods and guided on the columns by means of cast iron guide brackets. Pressure is supplied by a 3.8-g.p.m., 3000-p.s.i. capacity radial piston pump, driven by a 5-hp., 1200-r.p.m. motor. *(Please turn to page 208)*



News of the Industry

● The Princeton University's Class of 1913, celebrating its 30th reunion, awarded its achievement cup to George K. Scribner of Boonton, N. J., founder and president of the Boonton Molding Company and chairman of the advisory committee of Princeton's new program in plastics. His company is noted for its advanced labor relations policies. He becomes tenth winner of this cup.

● Among the corporations achieving "Merit Awards" in Financial World's annual report survey are Catalin Corp., Drackett Co., National Vulcanized Fibre Co., Thiokol Corp., Minnesota Mining & Mfg. Co. One of these will be awarded the bronze "Oscar of Industry" trophy for the best 1945 annual report of the plastics field in October.

● Both the S.P.I. and the S.P.E. have announced plans for their 1947 plastics exhibits. The 1947 National Plastics Exposition, run in conjunction with the S.P.I. Annual Meeting, will be held at the Coliseum in Chicago on May 5 to 11, 1947. The Stevens Hotel will be the Conference headquarters.

Present plans are for the Annual S.P.E. Plastics Exhibit to be at the Coliseum in Chicago during the week of Jan. 27, 1947. Meetings will emphasize the importance of informative labeling.

● Bakelite Corp., New York 17, N. Y., has recently acquired the former Inland Rubber Co.'s plant site northwest of Ottawa, Ill., in line with the company's program of expansion for increased production of Vinylite calendered film and press-polished rigid sheets.

● Dow Corning Corp., Midland, Mich., has released preliminary data on a new thermosetting silicone resin developed for use in formulating high heat and moisture resistant paints having a hard, mar-resistant surface. Known as DC 804, the resin is particularly recommended for use in formulating white finishes with properties between those of ceramic coatings and ordinary organic paints.

● Six divisions of the American Chemical Society will cooperate in sponsoring a High Polymer Forum at the 110th national meeting of the Society in Chicago, September 9 to 13, according to a recent announcement.

● American Viscose Corp., New York, N. Y., has contracted for the construction of building and facilities to increase by 50 percent its plant at Meadville, Pa.

● Accurate Molding Corp., Brooklyn 1, N. Y., has moved its factory and office to new and larger quarters at 35–20 48th Ave., Long Island City 1, N. Y.

● The Moulding Corp. of America, New York 12, N. Y., has announced purchase of the Plastics Division of All Metal Screw Products Co., Inc., New York 12, N. Y.

● A new stripper known as Enthone Enamel Stripper S-300 and used for removal of many types of organic coatings has been developed by the Enthone Co., New Haven, Conn. The new product is said to strip synthetic enamels such as alkyds, melamine- and urea-formaldehyde coatings cleanly by a wrinkling action which leaves the base metal unharmed.

● In line with its entry into the transparent film printing and processing business, Plastics Guild Corp., Paterson 4, N. J., has opened a new plant at 85 Fifth Ave. in Paterson to do coating, laminating, embossing and polishing of plastic films and other synthetics. Oliver Oakley Brant was recently elected president of the corporation.

● William K. Stamets Co., Pittsburgh 22, Pa., has been appointed exclusive distributor for the hydraulic press line manufactured by Denison Engineering Co., Columbus 8, Ohio, in sections of Pennsylvania, Ohio, Maryland and West Virginia. Bryant Machinery & Engineering Co., Chicago 6, Ill., will act as the distributor for Chicago and vicinity.

● The Fabrication Division of Ned G. Levien Co., Inc., Long Island City, N. Y., has been purchased by Amdur-Redlich Corp., Long Island City 1, N. Y.

● Celanese Corp. of America, New York 16, N. Y., has announced the start of construction of an addition to its plastics plant at Belvidere, N. J., for the production of cellulose acetate and cellulose propionate molding powder.

● Construction of the company's new plastics plant at Washington Bottom, near Parkersburg, W. Va., has been announced by E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. The plant is planned for the production of Lucite and polythene molding powders, as well as for the manufacture of nylon bristles and molding powder. It has also been disclosed that a Nylon Section has been established in the Chemical Div. of the Ammonia Department. Dr. E. C. Kirkpatrick has been appointed the director of the new section. Dr. A. G. Weber will be in charge of the General Section.

Sorry!

● On page 112 of the June issue we ran a photo of various articles displayed in in rigid vinyl and acetate boxes without mentioning that these products were used merely as samples to demonstrate the possibilities of the boxes.

● In our In Review section on page 91 of the May 1946 issue, we failed to mention that the holders for the Whirlpool and Bedlam Alphonse perfume containers were made by Triangle Plastics Company.

(Please turn to next page)

● Yet another indication of the growing awareness of retailers that the public wants and should know more about the plastic products they buy is the week-long plastics exhibit sponsored by Sibley, Lindsay & Curr Co. of Rochester, N. Y., in cooperation with MODERN PLASTICS Magazine, Tennessee Eastman Corp., Monsanto Chemical Co., Durez Plastics & Chemicals Inc. and Celanese Plastics Corp. on June 22 through June 29.

Full page newspaper ads were used to promote the exhibit as well as daily mention in the radio program called "Tower Clock Time. Each day a different exhibitor acted as the special host and that day's advertising featured that company's products and work.

● A new low cost coating said to produce a lustrous hammered effect in a single spray-coat application has been developed by Maas & Waldstein Co., Newark 4, N. J. The product, marketed as Motletone, is available as an air-dry or baking finish and may be used on metal equipment or molded plastic products and wood when a metal-like hammered finish is desired.

The company has also brought out a high gloss protective and decorative coating for polystyrene plastics which has been named Stylac. This air-drying lacquer is said to have good adhesion and humidity resistance.

● The Plastic Dye Laboratories of Krieger Color and Chemical Co., Hollywood 38, Calif., has developed a new colorant called Kriegr-O-Dip Universal Dye because it is said to simplify the coloring process of plastics including polystyrene, acetate, acrylics, vinyls and nitrate. It is used at room temperature.

● Beryllium Corp., Reading, Pa., has announced the dissolution of its totally owned subsidiary, the Beryllium Corp. of Pennsylvania.

● Hercules Powder Co., Wilmington, Del., has announced that Walter E. Gloor, plastics supervisor at the Parlin, N. J., plant, will head a new products development section of the Cellulose Products Department.

● Capac Mfg. Co., Capac, Mich., has been announced its incorporation as Capac Plastics, Inc.

Personnel changes

● Robert C. Hay, formerly with the sales department of E. I. du Pont de Nemours & Co., Inc., Plastics Div., has recently joined the Baker Instrument Co., Orange, N. J., manufacturer of chemical laboratory equipment.

● Dr. G. F. D'Alelio has resigned from Pro-phy-lac-tic Brush Co., Florence, Mass., as vice president and director of research to take the position of manager of high polymer research with Industrial Rayon Co., Cleveland, Ohio.

● It has been announced that Ralph E. Thompson has been elected to fill a vacancy on the board of directors of National Research Corp., Boston, Mass. Mr. Thompson is board chairman and director of Reed-Prentice Co., president and director of Scott and Williams, Inc.

● Stanley Sapery has resigned as sales manager of Victor Metal Products Co., Brooklyn, N. Y., and has opened his own office in New York where he plans to handle a complete line of packaging, plastics and allied products.

● Leon Neuman has withdrawn from Kenilworth Plastics Molding Co., Kenilworth, N. J. Saul Neuman and H. David Sprung will continue the business under the same name.

CHARLES P. CLIFFORD

● It was with sorrow that we learned of the death of Charles P. Clifford of American Insulator Corp., New Freedom, Pa., on June 9. Mr. Clifford joined the company in April 1940 as salesman in the New England states and in Sept. 1943 was appointed sales manager, a position which he held until his death.

● We regret to announce the death of Edgar L. Feininger, assistant general manager of the Chemical Dept., General Electric Co., Pittsfield, Mass.

● It is with sorrow also that we announce the death of Jack L. Carmitcheal, vice president of the Lincoln Engineering Co., St. Louis 20, Mo., on May 31.

● George F. Kahle has joined Heyden Chemical Corp., New York 1, N. Y., as a representative in the Chicago area.

● Sara Sutton has been appointed assistant to J. F. Nicholl, head of plastic fabrics development in the Lumite Div. of Chicopee Mfg. Corp., New York, N. Y., in which post she will specialize in plastic fabrics for upholstery and similar products.

● Carl H. Pottenger has joined Pennsylvania Coal Products Co., Petroolia, Pa., as vice president. He was formerly assistant sales manager of the Plastics Div., American Cyanamid Company.

● The Manufacturing Chemists Association of the U. S. has recently elected the following officers: Charles S. Munson, U. S. Industrial Chemicals, Inc., president; Leonard T. Beale, Pennsylvania Salt Mfg. Co., and H. O. C. Ingraham, General Chemical Co., vice presidents; J. W. McLaughlin, Carbide and Carbon Chemicals Corp., treasurer; and Warren N. Watson, Washington, D. C., re-elected secretary.

The executive committee elected is: George W. Merck, Merck and Co., chairman; Lammot du Pont, E. I. du Pont de Nemours & Co., Inc., vice chairman; H. L. Derby, American Cyanamid and Chemical Corp.; C. S. Hosford, Jr., Victor Chemical Works; John L. Smith, Charles Pfizer and Co., Inc.; Clyde D. Marlatt, Martin Dennis Co.; W. S. Landes, Celanese Corp. of America; P. T. Sharples, Sharples Chemicals, Inc; Y. I. Young, American Zinc, Lead and Smelting Co.; and William M. Rand, Monsanto Chemical Company.

● Dr. Crawford H. Greenewalt has been selected to succeed Jasper E. Crane as a vice president and member of the Executive Committee of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., following Mr. Crane's retirement. Frederick H. Weismuller is new assistant general manager of Pigments Dept. Also revealed was retirement of James B. Eliason as a vice president and treasurer, with Walter J. Beadle assuming his duties.

● Announcement has been made of the appointment of Harry K. Collins as manager of the Resin and Insulation Materials Div., General Electric Co., Pittsfield, Mass. Mr. Collins assumes responsibility for over-all activities connected with the company's silicone resins, oils, greases, rubber and water repellents as well as its Glyptal alkyd resins and insulating material.

Guy M. Stone has also been appointed manager of the Coshocton, Ohio, plant of the Plastic Div. for manufacture of laminates, now under construction.

● International B. F. Goodrich Co., division of B. F. Goodrich Co., Akron, Ohio, has announced appointment of Emory F. Smith as sales manager for Koroseal and other plastics merchandised by company.

● Marvin W. Maschke has been elected to the board of directors of Metal Specialty Co., Cincinnati 32, Ohio.

● Maurice Spain, Jr., has been appointed New England sales representative of the Chemaco Corp., Berkeley Heights, N. J.

● The interests of Bernard Schiller in Ardee Plastics Co., Inc., Long Island City 1, N. Y., have been purchased by Richard D. Werner and Herbert S. Werner. Mr. Schiller has joined the firm of Banner Plastics Corp., New York, N. Y.

Temperature and humidity

(*Continued from page 164*) sponding data on the effect of humidity are summarized in Table IX and the Izod values for the medium-acetyl products are graphed in Fig. 17.

To obtain information on the effect of weathering, tensile specimens of formulations 2 and 6 were exposed at 45° facing south in the open at Springfield, Mass., and Miami, Fla. Tensile properties were determined at two-month intervals. The results are summarized in Table X.

Discussion of results

The general effects of temperature and humidity on the mechanical properties of organic plastics have been summarized in a previous paper,[10] and detailed data of this type for cellulose acetate and cellulose nitrate sheet plastics have been reported separately.[8] The results of the present study present no contradictions to the earlier data and the same general conclusions hold throughout.

The behavior of injection molded cellulose acetate in tension changes markedly with changes in temperature, and the character of these effects is shown clearly by the stress-strain curves (Fig. 1). In general, yield stress, breaking strength and modulus of elasticity increase as the temperature is reduced and decrease as it is raised. Proportional limit changes in the same fashion (Fig. 2). The degree of plasticization influences the strength at any temperature but not the shape of the temperature-strength or temperature-modulus curve (Figs. 4, 5 and 8).

Elongation at break is greatly influenced by temperature also, and generally decreases as the temperature is lowered and increases as temperature is raised. However, a retrogression occurs at about 50° C. (122° F.), above which temperature these materials begin to become *weak* (Figs. 6 and 7). Ductility (elongation between yield point and break) follows the above trends

[10] T. S. Carswell and H. K. Nason, "Effect of Environmental Conditions on the Mechanical Properties of Organic Plastics," A.S.T.M. Symposium on Plastics, pp. 22–46 (1944); Modern Plastics *21*, 121–6, 158, 160 (June 1944), 125–130, 160, 162 (July 1944).

Table VI.—Effect of Temperature on Flexural Strength of Injection Molded Cellulose Acetate

Formulation No.		*1*	*4*	*2*	*3*	*5*	*8*	*6*	*7*
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
−25° C. (−13° F.)	Moisture content, %	0.11	0.32	0.25	0.26	0.36	0.40	0.32	0.27
	Max. fiber stress, p.s.i.	20,240	15,580	16,120	13,520	16,310	16,590	15,340	12,870
5° C. (41° F.)	Moisture content, %	...	...	...	...	...	...	...	...
	Max. fiber stress, p.s.i.	16,720	14,640	13,440	10,180	8,770	12,890	11,700	10,020
25° C. (77° F.)	Moisture content, %	0.29	0.27	0.23	0.20	0.23	0.19	0.21	0.18
	Max. fiber stress, p.s.i.	9720	8380	7420	5210	8890	8090	6860	5140
45° C. (113° F.)	Moisture content, %	0.23	0.22	0.18	0.23	0.19	0.19	...	0.17
	Max. fiber stress, p.s.i.	6080	5840	4650	3120	6040	5210	4280	2710
60° C. (140° F.)	Moisture content, %	0.16	0.13	0.27	0.12	0.12	0.18	0.13	0.11
	Max. fiber stress, p.s.i.	5260	4810	3520	2100	5280	4270	2940	1460
80° C. (176° F.)	Moisture content, %	...	...	...	...	...	...	...	...
	Max. fiber stress, p.s.i.	2950	2500	1790	510	2480	1050	1150	0

Table VII.—Effect of Relative Humidity at 25° C. (77° F.) on Flexural Strength of Injection Molded Cellulose Acetate

Formulation No.		*1*	*4*	*2*	*3*	*5*	*8*	*6*	*7*
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
Dry 0% R.H.	Moisture content, %	0.29	0.27	0.23	0.20	0.23	0.19	0.21	0.18
	Max. fiber stress, p.s.i.	9720	8380	7420	5210	8890	8090	6860	5140
20% R.H.	Moisture content, %	0.57	0.51	0.45	0.42	0.49	0.42	0.40	0.36
	Max. fiber stress, p.s.i.	8220	7330	6400	4330	8200	7010	6080	4410
50% R.H.	Moisture content, %	0.92	0.81	0.78	0.75	0.70	0.74	0.62	0.63
	Max. fiber stress, p.s.i.	7270	6770	5900	4160	7780	6770	5890	4220
55% R.H.	Moisture content, %	1.03	1.11	0.98	0.89	0.84	0.86	0.79	0.65
	Max. fiber stress, p.s.i.	7290	6220	5440	3840	7540	6800	5720	4030
65% R.H.	Moisture content, %	1.45	1.52	1.41	1.34	1.25	1.21	1.15	1.10
	Max. fiber stress, p.s.i.	6140	5630	4620	3370	6790	5740	5010	3450
80% R.H.	Moisture content, %	1.91	1.78	1.82	1.51	1.59	1.64	1.47	1.35
	Max. fiber stress, p.s.i.	5460	4810	4170	2790	6210	5220	4110	2970
Saturated atmosphere	Moisture content, %	2.15	2.26	2.00	1.89	1.81	1.74	1.55	1.89
	Max. fiber stress, p.s.i.	5120	4070	3680	2330	5880	4680	3920	2640

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Table VIII.—Effect of Temperature on Impact Strength of Injection Molded Cellulose Acetate

Formulation No.		1	4	2	3	5	8	6	7
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
−25° C. (−13° F.)	Moisture content, %	0.11	0.32	0.25	0.26	0.36	0.40	0.32	0.27
	Izod, ft.-lb./in. notch	0.42	0.42	0.27	0.31	0.34	0.41	0.47	0.37
	Charpy, ft.-lb./in. notch	0.47	0.39	0.34	0.37	0.33	0.36	0.51	0.41
5° C. (41° F.)	Moisture content, %	..	..	..	..	..	..	..	..
	Izod, ft.-lb./in. notch	0.45	1.20	1.32	1.96	0.52	1.24	1.50	1.72
	Charpy, ft.-lb./in. notch	0.49	1.28	1.20	2.27	0.51	1.80	1.63	2.15
25° C. (77° F.)	Moisture content, %	0.29	0.27	0.23	0.20	0.23	0.19	0.21	0.18
	Izod, ft.-lb./in. notch	2.14	2.17	2.42	2.71	1.82	1.89	2.06	2.48
	Charpy, ft.-lb./in. notch	2.64	2.94	3.13	3.39	2.35	2.85	2.90	3.21
45° C. (113° F.)	Moisture content, %	0.23	0.22	0.18	0.23	0.19	0.19	..	0.17
	Izod, ft.-lb./in. notch	3.18	3.32	3.51	6.61	3.43	3.06	4.14	7.18
	Charpy, ft.-lb./in. notch	4.51	4.40	4.48	5.37	3.87	4.48	5.04	5.65
60° C. (140° F.)	Moisture content, %	0.16	0.13	0.27	0.12	0.12	0.18	0.13	0.11
	Izod, ft.-lb./in. notch	3.87	3.05	5.63	7.64	3.44	3.46	7.54	7.65
	Charpy, ft.-lb./in. notch	5.10	3.82	4.37	6.28	4.10	4.36	5.56	7.21
80° C. (176° F.)	Moisture content, %	..	..	..	..	..	..	..	..
	Izod, ft.-lb./in. notch	9.17	7.90	8.41	8.20	8.45	9.05	8.83	7.86
	Charpy, ft.-lb./in. notch	9.10	5.08	7.27	7.49	7.09	8.93	9.09	7.16

also and disappears entirely somewhere between 0° C. (32° F.) and −25° C. (−13° F.). Below this point rupture takes place before a yield point is reached. This behavior is a good illustration of the effect cited by Carswell and Nason,[11] the point of rupture moving back toward the origin along the generalized stress-strain curve as the temperature is reduced. As ductility decreases, toughness as measured by impact tests would be expected to decrease also, and this is shown to be the case (Fig. 16).

[11] T. S. Carswell and H. K. Nason, *loc. cit.*, Ft. 10.

Plasticizer formulation appears to have more influence on elongation than it does on strength, with respect to temperature effects. The inclusion of aromatic phosphate ester appears to improve ductility at elevated temperatures (Figs. 6 and 7). As might be expected, an increase in plasticizer content, of any given type, improves elongation at all temperatures, although the differences are small at low temperatures.

The effect of temperature on flexural strength follows the same trends as on tensile yield stress.

The impact strength of injection molded cellulose

Table IX.—Effect of Relative Humidity at 25° C. (77° F.) on Impact Strength of Injection Molded Cellulose Acetate

Formulation No.		1	4	2	3	5	8	6	7
A.S.T.M. type (D 706–44 T)		*II, 7*	*I, 2*	*III, 9*	*III, 10*	*IV, 13*	*IV, 14*	*IV, 15*	*III, 10*
Dry	Moisture content, %	0.29	0.27	0.23	0.20	0.23	0.19	0.21	0.18
0% R.H.	Izod, ft.-lb./in. notch	2.14	2.17	2.42	2.71	1.82	1.89	2.09	2.48
	Charpy, ft.-lb./in. notch	2.64	2.94	3.13	3.39	2.35	2.85	2.90	3.21
20% R.H.	Moisture content, %	0.57	0.51	0.45	0.42	0.49	0.42	0.40	0.36
	Izod, ft.-lb./in. notch	2.62	2.60	2.61	3.15	2.03	2.31	2.62	2.59
	Charpy, ft.-lb./in. notch	3.43	3.28	3.54	3.98	2.92	3.33	3.68	3.73
50% R.H.	Moisture content, %	0.92	0.81	0.78	0.75	0.70	0.73	0.62	0.63
	Izod, ft.-lb./in. notch	2.70	2.38	2.74	3.14	2.08	2.45	2.82	2.98
	Charpy, ft.-lb./in. notch	3.75	3.27	3.61	3.97	3.09	3.40	3.86	3.61
55% R.H.	Moisture content, %	1.03	1.11	0.98	0.89	0.84	0.86	0.79	0.65
	Izod, ft.-lb./in. notch	3.19	2.88	3.01	3.46	2.45	2.39	3.25	3.14
	Charpy, ft.-lb./in. notch	4.51	3.59	4.08	4.08	3.28	3.25	4.28	4.08
65% R.H.	Moisture content, %	1.45	1.52	1.41	1.35	1.25	1.21	1.15	1.10
	Izod, ft.-lb./in. notch	3.43	2.95	3.34	6.32	2.73	2.92	3.59	3.41
	Charpy, ft.-lb./in. notch	4.48	3.85	4.18	5.05	3.70	3.97	4.70	3.94
80% R.H.	Moisture content, %	1.91	1.78	1.82	1.51	1.59	1.64	1.47	1.35
	Izod, ft.-lb./in. notch	3.91	3.67	4.00	6.76	3.09	3.26	3.92	4.38
	Charpy, ft.-lb./in. notch	4.93	4.58	4.64	6.26	3.79	3.93	4.79	4.27
100% R.H.	Moisture content, %	2.15	2.26	2.00	1.89	1.81	1.89	1.74	1.55
	Izod, ft.-lb./in. notch	4.40	4.18	4.57	7.24	3.22	3.77	5.10	5.18
	Charpy, ft.-lb./in. notch	5.68	5.18	5.29	6.57	4.23	4.72	5.14	4.94

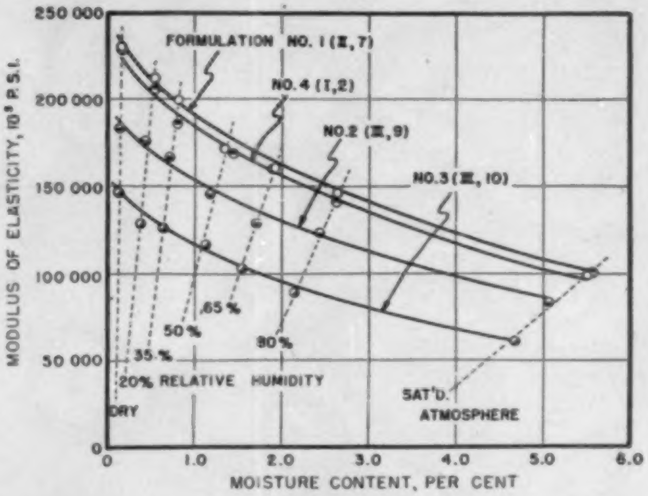
Table X.—Effect of Weathering on Tensile Properties of Injection Molded Cellulose Acetate

Duration of exposure to weather	Location of exposure	*Tensile yield stress* Formulation 2 A.S.T.M. type III, 9	*Tensile yield stress* Formulation 6 A.S.T.M. type IV, 15	*Elongation at break* Formulation 2 A.S.T.M. type III, 9	*Elongation at break* Formulation 6 A.S.T.M. type IV, 15	*H_2O content when tested* Formulation 2 A.S.T.M. type III, 9	*H_2O content when tested* Formulation 6 A.S.T.M. type IV, 15
months		*p.s.i.*	*p.s.i.*	*percent*	*percent*	*percent*	*percent*
0	...	3510	3330	28.0	44.0	1.05	0.82
2	Springfield, Mass.	3820	3730	22.0	23.0	1.36	1.00
	Miami, Fla.	4200	4070	18.0	24.0	1.42	1.00
4	Springfield, Mass.	4110	3970	18.0	29.0	1.34	1.00
	Miami, Fla.	3670	3780	7.7	11.0	1.49	1.04
6	Springfield, Mass.	4110	3970	16.0	22.0	1.43	0.93
	Miami, Fla.	3770	3620	2.0	3.0	1.45	1.07

acetate is very greatly influenced by changes in temperature, as would be expected from examination of the stress-strain curves. Impact resistance falls off rapidly below about 20° C. (68° F.) and levels off to values in the range of 0.28 to 0.50 ft.-lb. per in. of notch at temperatures below about −10° C. (15° F.). Impact strength at any temperature tends to increase with increase in plasticizer content, although the differences are negligible at temperatures below about −20° C. (−4° F.).

Moisture acts as an efficient plasticizer for cellulose derivatives, and the properties of cellulose acetate plastics are influenced considerably by the amount of moisture present. This amount depends upon the relative humidity of the ambient atmosphere at any given temperature.

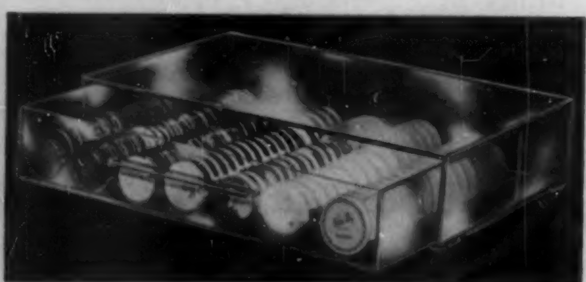
Examination of the stress-strain curves of Fig. 3 shows that yield stress, breaking strength and modulus of elasticity are increased by reduction in humidity and



13—*Effect of relative humidity on modulus of elasticity of injection molded cellulose acetate (medium-acetyl formulations were used)*

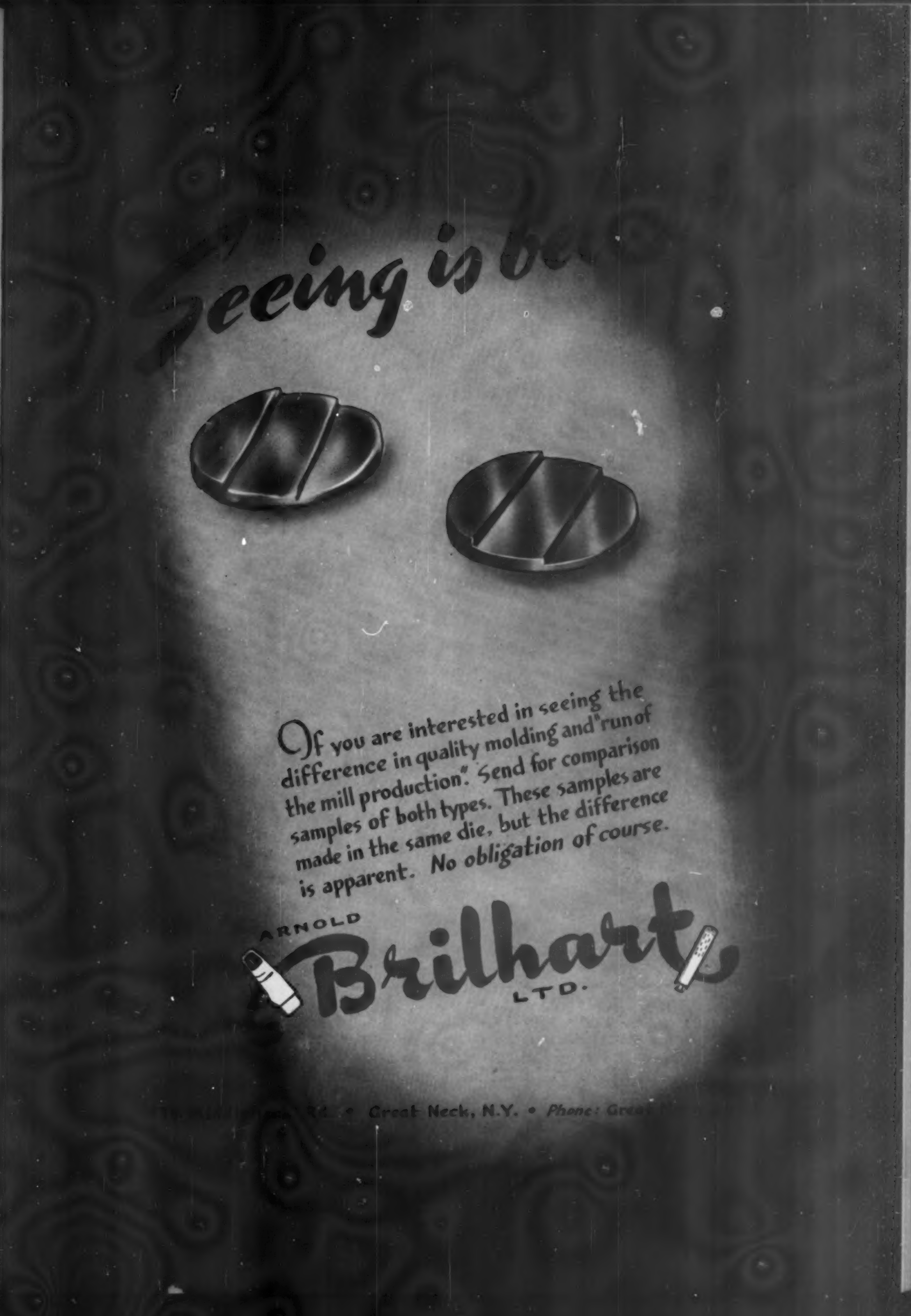
KNOWING full well the weakness of women for pretty things, Pasedena Plastic Co. has created an eye-appealing Lucite display rack that puts its best foot forward to show off its merchandise—in this case, pancake pats of rouge.

Simply but effectively constructed, the acrylic case is actually nothing more nor less than a drawer with a plastic pull. But through the expedient of using the crystal-clear material the manufacturer has achieved top sales appeal.



For too long the average druggist has hidden wares of this sort in drawers accessible only to himself and his clerks. The customer had to specify a particular brand or else rely on the choice of the druggist who generally pulled out whatever box his hand touched first. Now with cosmetics in full view of the one who is making the purchase, the woman is free to inspect all the types offered and select whichever seems best suited to her needs.

This efficient display rack is fitted with a sheet of acrylic that has been heated and shaped into troughs to hold seven rows of the flat rouge boxes. Other displays produced by this plastic company have different fittings for lipsticks or for other cosmetics. All make the most of the decorative highlights peculiar to the plastic material whose light weight and comparative shatter-resistance keep the racks practical as well as attractive in appearance.



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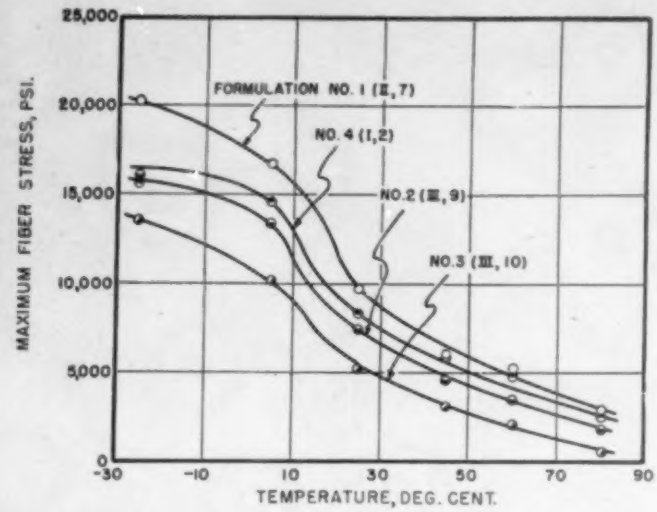
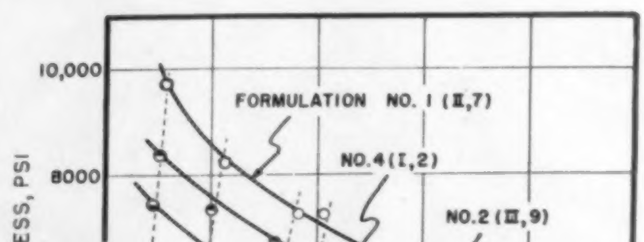
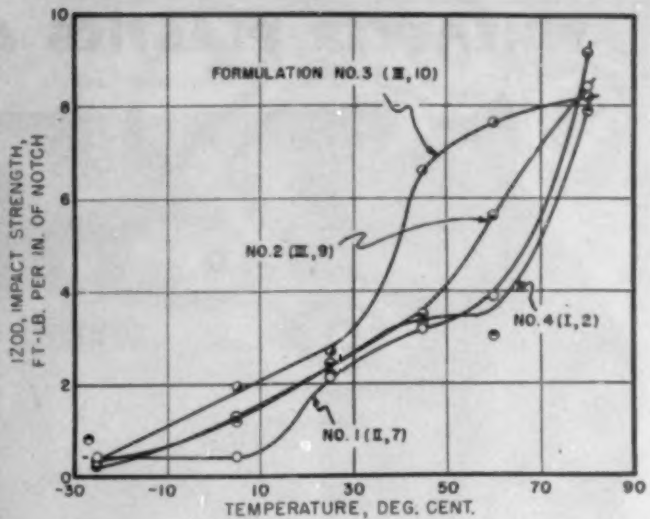


14—Effect of temperature on flexural strength of injection molded cellulose acetate (medium-acetyl formulations)

vice versa, whereas elongation is decreased by reduction in humidity and increased by increase in humidity. Figures 9 and 10 show how yield stress varies with humidity and the relation between humidity and moisture content of the specimen. In general, as plasticizer content is increased, moisture absorption at any relative humidity level is decreased. However, the general nature of the yield stress/moisture content curves seems to be independent of plasticizer content. The same trends are evident with respect to modulus of elasticity (Fig. 13) and flexural strength (Fig. 15). It is interesting to note also that the formulations from high-acetyl content cellulose acetate absorb less moisture at any given humidity than do the medium-acetyl formulations, but effects of variations in humidity on



15—Effect of relative humidity on flexural strength of injection molded cellulose acetate (these are medium-acetyl formulations)



16—*Effect of temperature on impact strength of injection molded cellulose acetate (medium-acetyl formulations)*

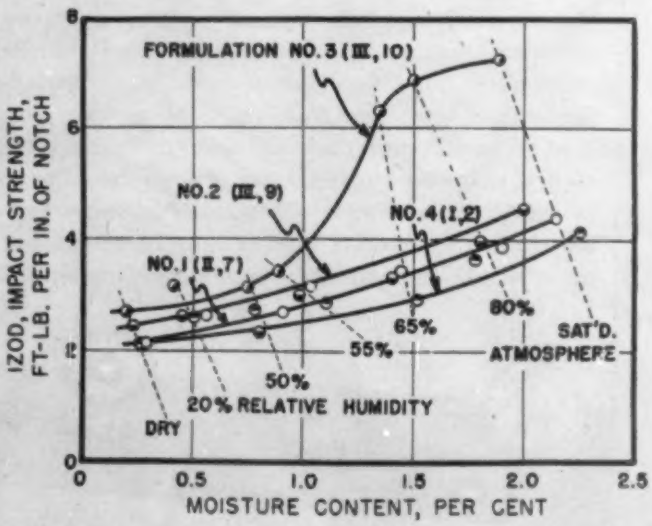
strength properties follow exactly the same trends, qualitatively and quantitatively (Figs. 9 and 10). Phosphate ester in the plasticizer formulation tends to decrease moisture absorption slightly especially at very high humidities (Figs. 9, 10, 11, 15 and 17).

The plasticizing action of moisture is quite evident in the impact data (Fig. 17); toughness, as measured by this test, increases appreciably as humidity is increased.

The above data should be utilized when designing parts of cellulose acetate for applications which involve exposure to temperatures or humidities appreciably different from normal.

The effect of exposure to the weather on the strength properties of cellulose acetate and cellulose nitrate sheet plastics has been described in a previous publication.[12] The data herein presented (Table X) show that injec-

[12] T. S. Lawton, Jr., and H. K. Nason, "Effect of Some Environmental Conditions on the Permanence of Cellulose-Acetate and Cellulose-Nitrate Sheet Plastics," Trans. A.S.M.E. 67, 259–266 (May 1945); Modern Plastics 22, 145–150, 176, 178 (Jan. 1945).



17—*Effect of relative humidity on impact strength of injection molded cellulose acetate (these are medium acetyl formulations)*

tion molded cellulose acetate formulations resemble cellulose acetate sheet plastics in that prolonged weathering impairs ductility and toughness. It is possible to retard this deterioration markedly by the incorporation of special plasticizers in the composition,[13] and such formulations should be chosen for applications where direct outdoor exposure for long periods of time is involved.

Acknowledgment

We are indebted to Mr. Charles Trudeau and Dr. David Telfair for assistance in the experimental work.

[13] L. W. A. Meyer and W. M. Gearhart, "Weather Resistance of Cellulose Ester Plastic Compositions," Ind. Eng. Chem. *37*, 232–9 (Mar. 1945).

Manufacture of phenolic

(*Continued from page 158*) with constant stirring. Likewise the calcium hydroxide, made into a paste with alcohol, is added in portions. After the mixture has been stirred for 12 hr. the greater part of the resin will be dissolved. Then the temperature is raised to 35° C. for 4 hr. to obtain complete solution, after which the batch is cooled and run through a screen.

Laminating varnish T4/LTx (see Table IV)

The alcohol is put into the kettle. The pulverized resin, together with the hexamethylenetetramine, is added in portions with constant stirring. After the mixture has been stirred for 10–14 hr. at 20–25° C., the temperature is raised to 35° C. in order to obtain complete solution. After cooling to 25° C., the dry magnesium stearate is added through a screen and dispersed in the resin solution by stirring for 30 minutes.

For the paper board industry, a solution is made with Resin T4 of 70–80 cp. viscosity and an addition of 6 kg. of calcium hydroxide. The calcium hydroxide is mixed with some alcohol to a thin paste and added to the mixture after the resin. Otherwise the composition is the same as for regular T4/LTx, and the yield and analytical data are the same.

Tanks for transporting resin solutions between buildings

New machinery and equipment

(Continued from page 190)

● A new electronic potentiometer-pyrometer which has no continuously moving or vibrating parts in its measuring circuit is announced by Bailey Meter Co., Cleveland 10, Ohio. It records one or two temperatures on a 12-in. diameter uniformly graduated chart and indicates on a 29-in. bold scale which encircles the recording chart. A 115-volt, 60 or 50-cycle, A-C power supply is required. The pyrometer may be furnished with two controllers operating from two entirely separate measuring circuits all housed in the same recorder casing. This permits double the number of recorder controllers to be included in a given panel space. The Pyrotron recorder-controllers are furnished for air-operated control systems and throttling type electronic control systems.

● A permanent non-electric magnetic separator, designed for installation on individual plastics molding machines, has been introduced by Eriez Mfg. Co., Erie, Pa. The unit, placed in the aluminum or steel chute of injection and extrusion machines, just below the measuring cylinder, will attract and hold all ferrous particles, passing within $1^1/_2$ in. of its face. Less than a minute daily is required to clean it and it is guaranteed to retain its strength for at least 10 years.

● Complete sets of either numbered, lettered or fraction-type drill size pin gages, all in one case, have been announced by The Horberg Gage Co., Bridgeport 1, Conn. Twin gages of each size are held upright in case and each pin is clearly identified. Gages, of oil hardened tool steel, are made to tolerance of +0.0001 −0.0000 and are tapered halfway up the shank for easy insertion. They are available with round, polished top and flat, ground bottom.

● Colloid Equipment Co., Inc., New York 7, N. Y., has announced the development of a new Delmhorst moisture detector for sheet materials. The meter operates on a 60 cycle, AC lighting circuit with 110 volts. It is said to have an accuracy ranging from 3 to 15 percent depending on the material tested. The meter scale is calibrated in electrical units which are easily translated into moisture contents by testing several samples of similar material whose moisture contents have been previously determined by the usual standard oven method. The unit is compact, portable and weighs less than 10 lb. Three tests can be made in one minute.

● Spring Specialty Co., Maywood, Ill., has announced a high-speed direct-connected Leigh flexible shaft grinder which operates at a free speed of 18,000 r.p.m. Some of the new features incorporated in this grinder are: a patented shaft with liner that is claimed to stand up under continuous operation, and a ball bearing spindle with an integral cam-locking $^1/_4$-in. collet. Additional auxiliary insert collets can be supplied to accommodate $^1/_8$-, $^3/_{32}$- and $^3/_{16}$-in. arbors.

● A hydraulic generator with finger-tip control delivering from 0 to 5000 p.s.i. and 40 hp. with volume ranging from 0 to 17 g.p.m. at 1200 r.p.m. is being manufactured by Superdraulic Corp., Dearborn, Mich. This new pump has been developed in two types, one for constant delivery, the other for finger-tip controlled variable delivery. This radial type plunger pump is arranged so that centrifugal force maintains the plunger rollers in contact with an elliptical reaction ring. The plungers are fitted to cylinders in a rotor in one or more banks of 11 plungers per bank. Each plunger makes two inlet and two delivery strokes per revolution. An equalizing axle, journaling a roller at each end, is universally attached to the outer end of each plunger. While taking full advantages of balanced forces to produce high pressures and volumetric delivery without resorting to heavy sections the unit can be easily lifted and is about the size and weight of a $^1/_4$ hp. electric motor.

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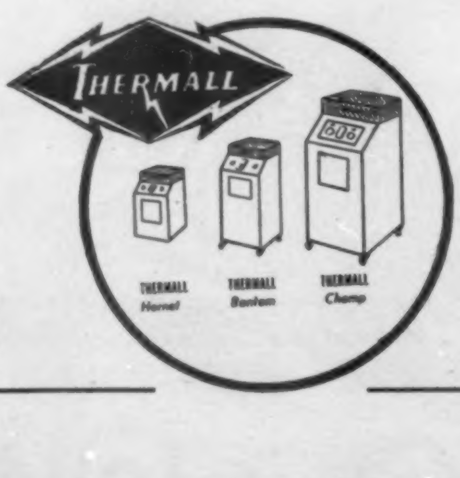

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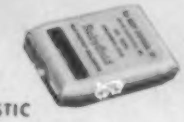

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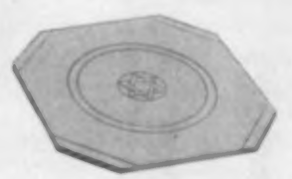

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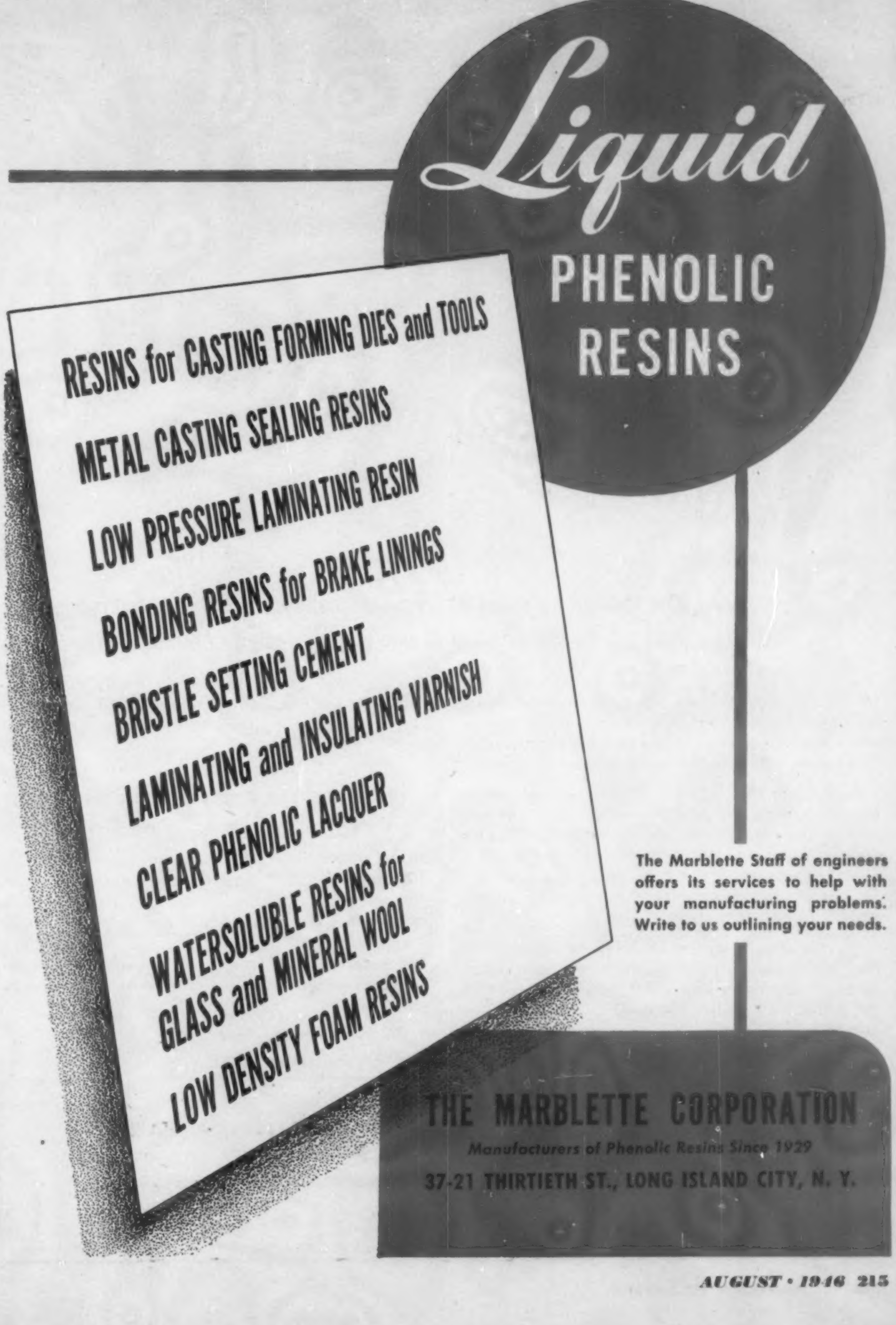
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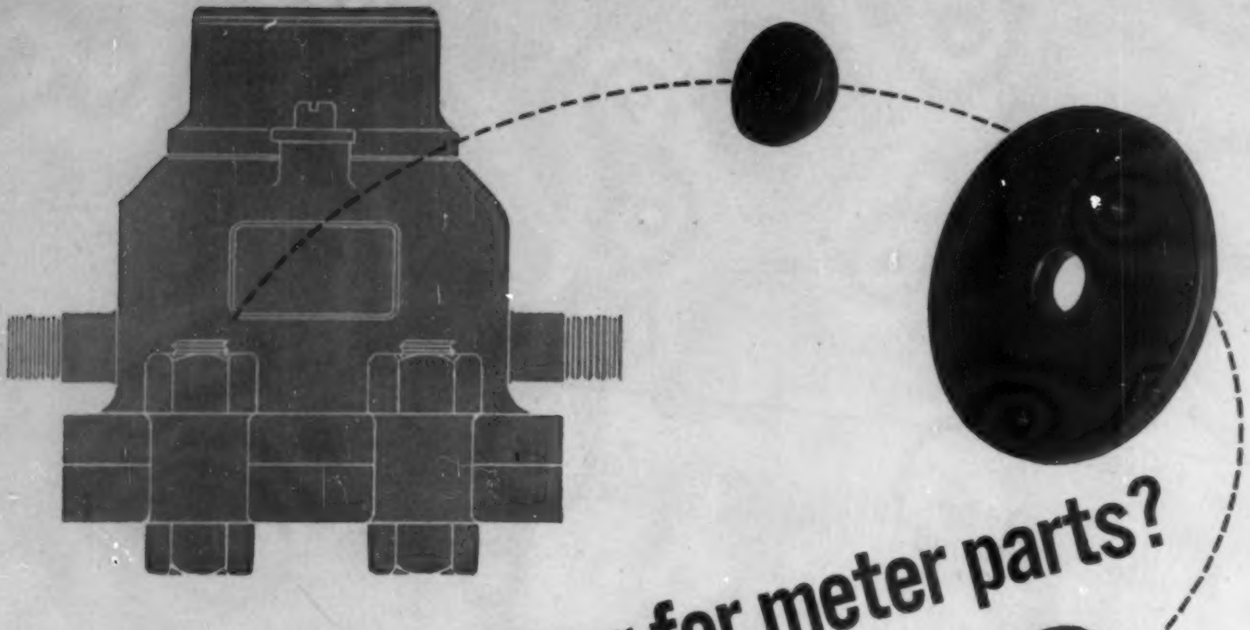

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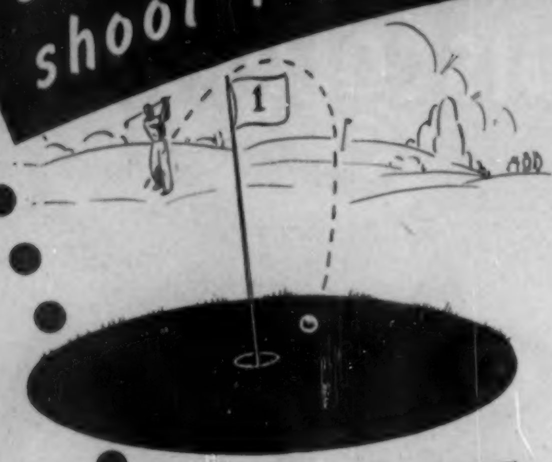

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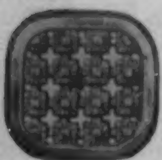

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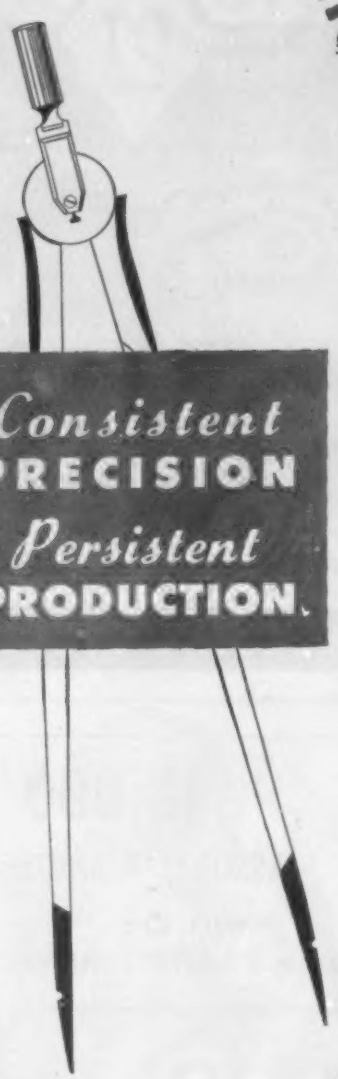

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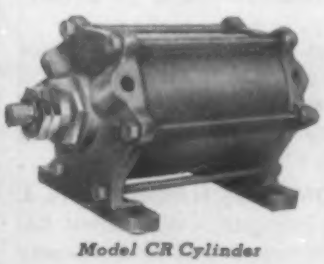

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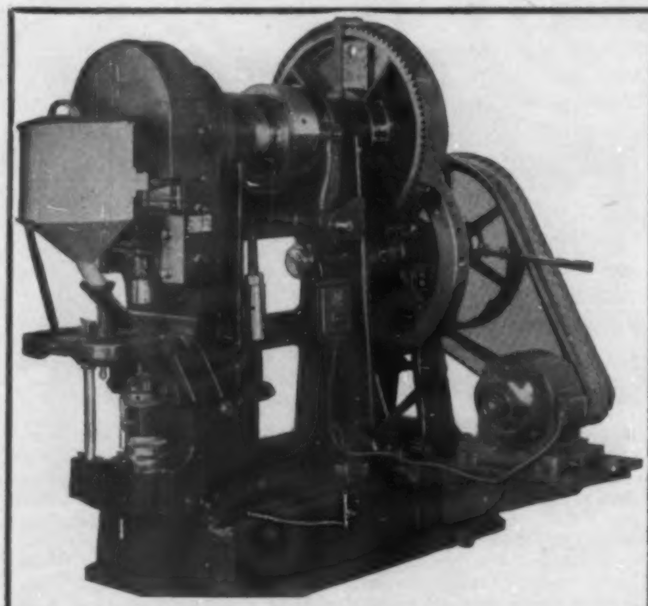

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FOR SALE: 1—HPM Injection Molding Press 1½ oz. Complete with 5 HP motor, starter and temperature controls. Reply Box 1558, Modern Plastics.

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VINYL FILM PLASTIC SCRAP
Can use unlimited quantities. Prefer waste from mfrs. of Shower Curtains, Garment Bags, Umbrellas, Raincoats, etc. Send samples and advise quantities. Reply Box 1592, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

DO YOU NEED a Hydraulic Press for Compression Molding, Transfer Molding, Laminating, Forming, Bending and Hobbing? Whatever it may be, if it is hydraulic, see Sal-Press Company, 388 Warren Street, Brooklyn, N. Y.

EXPERIENCED DIE MAKERS

For plastic molds—must be fully qualified—wanted by an old established Los Angeles concern—top wages—no designing. Write us your qualifications giving details of experience and ability.

Box C107. Modern Plastics Magazine
122 E. 42nd St., New York 17, New York

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

RESIN SALES REPRESENTATIVES wanted. Young manufacturing concern will make commission or other arrangements. Urea-Formaldehyde and Phenol-Formaldehyde Resins available in liquid, lump, pulverized and spray-dried forms. Also Contact-Pressure Resins. Reply Box C110, Modern Plastics.

WANTED: TOOL AND DIE MAKER. Established plastics company needs expert tool and die maker with vast plastic experience, preferably familiar with injection molding. A real opportunity for advancement. Pension plan and insurance fully paid by company. Metropolitan New York area. Write giving full details and salary expected. All replies strictly confidential. Reply Box C108, Modern Plastics.

WANTED: Experienced Injection Molding Supervisor. Excellent opportunity for qualified applicant to assume complete supervision of plant in Mid-South city. Must be thoroughly familiar with all thermoplastics, molds and machinery. Furnish complete information concerning experience, qualifications, and salary expected. Reply Box 1572, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

CONTACT PRESSURE RESINS, flexible and nonflexible types now available. High quality resins. Reliable concern willing to make sales arrangements on commission basis—full or part time—if you have good selling connections. Reply Box C109, Modern Plastics.

FOR SALE: Poker Chip Mold, Compression, suitable powder, preform. Chips 1 9/16 dia. x 1/8—square edge—interlocking design. Channelled for steam, top and bottom, complete with knock out bars. A-1 condition. Size 16 x 20. Also 36 Cav. Comp. Mold for Paring Knife Handles. Blades molded as inserts into handles, elim. assembly, cementing operations. A-1 condition. Size 15 x 30. Reply Box C111, Modern Plastics.

WANTED: Used injection machines 4 oz. up, export. It will be impossible for years to get material for all machines in use. Competition is getting tough. Sell now. Write us make, year, and price. Reply Box 1528, Modern Plastics.

Large firm seeks man who can independently conduct a jobbing division handling Vinyl Plastics for handbag and shoe trades. Applicant must know sources of supply. Excellent opportunity. Reply Box C112, Modern Plastics.

MANUFACTURERS' EXCLUSIVE EXPORT AGENT. Introduced to many leading Exporters. Open for competitive lines of Fountain Pens; all kinds of Brushes; Plastic Powder and Resins; electrical, surgical and radio products and patented items. Showroom Midtown. Payment in N. Y. in U. S. currency. Reply Box C114, Modern Plastics.

FOR SALE—Number 3 Royal Extruder. Suitable for plastics—X-Alloy liner—Roller Thrust-Principles only. Reply Box C115, Modern Plastics.

NEW PRODUCTS wanted by well-known manufacturer with national sales force and top-flight advertising and promotion program. If you are manufacturing a quality item in the stationery and office supply line and want national distribution this year in stationery, department, drug and variety stores, write us giving full details of your product. Reply Box C116, Modern Plastics.

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PLASTICS COLOR TECHNOLOGIST: Permanent position with expanding Northern New Jersey company available for young chemist or physicist with at least two years experience in the color matching of Thermoplastics. Submit details of education and experience. Reply Box C117, Modern Plastics.

TESTED BUSINESS IDEA! To sell goods under competitive conditions—Proven direct mail writer, 32 . . . ten years of merchandising lots of it shoeleather. Was sales asst. to Pres. of manufacturing firm. Ex army officer but wife thinks he's a regular guy anyway. Prefers small firm where he can bite into a good share of work, and money. Reply Box C119, Modern Plastics.

Mechanics of Materials Engineer
Graduate Engineer, B.S. Building Engineering and Construction, Sc.D. Civil Engineering, specializing in Mechanics of Materials, M.I.T. Interested in determining and improving mechanical properties of plastic materials for new uses. Experience in research, teaching and consulting. Reply Box C126, Modern Plastics.

FOR SALE
2—Vickers Oil Pumps 17 GPM 500 to 1000#; Metalwood Horizontal 4 plunger 1 GPM 3000#; 1—Rumsey Vertical Triplex 300 cubic inches 3000#; 1—Gould Vertical Triplex 24 GPM 2500#; 1—Robertson Vertical Triplex Pump 7 GPM 5000#; 1—Robertson Vertical Triplex Pump 4 GPM 6500#; 2—Gould Vertical Triplex 200 GPM 400#; 1—Elmes Horizontal 4 Plunger 6½ gallons 5000#; 2—Galland Henning Horizontal 4 plunger Pumps 50 GPM 2000#; 25 Ton "C" Frame High Speed Press 2—42 x 42" 14" ram presses; 30 ton Watson Stillman 12 x 12" Laboratory Presses; Helo Shaw variable pressure 33 GPM 2500#; Racine Pumps 30 GPM 1000#; Racine Boosters 3 to 1 ratio; Racine miscellaneous valves; 750 ton Hydraulic Press; W. S. Vertical 2 pl. pumps 176 cubic in. 6000#. Reply Box 1225, Modern Plastics.

SITUATION WANTED. Designing, Fabricating, or Selling Thermoplastics. One year Development and three years Production experience. Desire Southern California Location. Reply Box C121, Modern Plastics.

Established, well rated fabricator of plastics is in the market for injection and compression moulds for gift and houseware items, toys, jewelry, etc. Will consider moulds for other items for volume production. Interested parties will receive prompt, confidential action from principals.
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FOR SALE: HPM 500 ton Mold. Presses 42" x 48"; D. & B. 500 ton 42" x 48"; 200 Ton 42" x 42" Farrel-Birm. 150 & 175 Ton: also 20 to 250 Tons from 36" x 36" to 12" x 12"; 40 Ton Broaching Press; 400 Ton Extrus. Pr.; W. S. Hor. 4 Plgr. 1" and 2" x 4" H. & L. Pressure Pumps; HPM 1⅜" x 6" Vert. Triplex 10 GPM 2700 lbs.; 7 Hydr. Oil Pumps, Vickers, Oilgear, Northern, etc.; Elmes 1" x 4" and 1⅛" x 4" hor. 4 plgr. 5 to 8 GPM 4500 lbs. and 5500 lbs.; Rumsey 4½" x 8" vert. triplex, 65 GPM 900 lbs.; Elmes 2½" x 4" hor. 2 plgr., 17 GPM 850 lbs.; 10 HP horiz. 1½" x 4" triplex 6 GPM 3000 lbs.; New Vickers 1¼" Oil Relief Valves; New Vickers ¾" Flow Control Valves; 2—Adamson 6" Extruders. Hydr. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Accum. Heavy Duty Mixers; Roller Conveyor, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 Broome St., NEW YORK 13, N. Y. CANAL 6-8147.

WANTED: Hydraulic Press 500 ton, 48" x 48" platen, 36" daylight, steam heated, in good condition. Need not have these exact specifications. Reply Box C123, Modern Plastics.

HELP WANTED
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Wanted: Polystyrene Powder or scrap in any color or amount. Also acetate or Ethyl Cellulose. Please quote price and delivery. Also interested in Steady Source for Polystyrene. Willing to pay top prices for quick delivery. Reply Box C113, Modern Plastics.

FOR SALE: Pat. #2367451. Heaters for extrusion nozzles. H. West, 32 N. Rockburn St., York, Pa.

WANTED: MOLDING FOREMAN, small plant, complete knowledge of molds and die setting, and finishing. Reply Box C120, Modern Plastics.

WANTED: Methyl Methacrylate—Lucite—Plexiglas, sheets and rods, also scrap. We are in a position to purchase large quantities of surplus materials of types listed. We are also looking for work on fabricated items. Inquiries invited.
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WANTED

Production Manager for leading New England Plastic Co. Must be capable of directing a thousand employees, scheduling and coordinating compounding, extruding, molding, fabricating, assembling and special departments. Opportunity for a man thoroughly experienced in Plastic production. Write Box C124, Modern Plastics.

TOP FLIGHT CHEMIST
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The man we want is employed, but is interested in advancement. He knows molding materials from all angles, particularly research, properties, applications. For such a man there is a permanent position in the research department of one of the leading electrical parts manufacturing companies in the NY-Phila. area. Will pay what is necessary for the right man. Write giving complete details, training and experience. Box C125, Modern Plastics.

WANTED: 8-9 oz. Injection press. Also thermoplastic scraps or rejects in any form. Information to a source for any of the aforementioned items would be greatly appreciated. Reply Box C128, Modern Plastics.

YOUR ASSETS and CAPITAL STOCK are WORTH MORE NOW. We are willing to PAY YOU CASH for your INDUSTRIAL PLANTS, MFG. DIVISIONS or UNITS. We are principals acting in our own behalf. All transactions held in strictest confidence. Personnel retained wherever possible. Address: Box 1230, 147 W. 42 St., New York 18, N. Y.

FOR SALE: Hydraulic Presses, 1—self contained completely automatic 5 tons capacity, 1—42" x 42" 16" ram, 250 tons; 1—36" x 36", 16" ram, 250 tons, 1—24" x 24" 6" ram, 75 tons, 1—26" x 52" 14" ram, 385 tons, 5—12" x 12", 7½" rams, 50 tons, 1—12" x 12", 6½" ram, 50 tons with pushbacks; 2—15" x 15" 8" rams, 75 tons; 3—19" x 24", 10" ram, 78 tons; 3—13" x 19", 12" ram, 100 tons; 1—20" x 20", 13" ram, with pullbacks, 200 tons; 3—23" x 17½", 8" ram; 75 tons; 1—16" x 17", 8" ram, 75 tons; 1—22" x 15", 8" ram, 75 tons; 7—12" x 13", 6½" ram, 50 tons, 4—8" x 9½", 4½" ram, 20 tons; PUMPS: 1 HPM Triplex 1½ GPM 2500#; 1—4 plunger 6 GPM 2000#; 1 Robertson Duplex 1½ GPM 4000#, 1 Hele Shaw JLP 12, 44 GPM 1200# with new control; 2 Vickers Units 20 GPM 2000#, 1 Gould Triplex 12 GPM 1250#, 1 Worthington 2½ GPM 4000#, 1 Worthington Triplex 12 GPM 2500#, 1 Elmes Duplex 1½ GPM 2850#; Accumulators, 1—W&S new 6000# hydro-pneumatic unit; Extruders, Housatonic 6" worm; Preform Machines, Stokes DDS-2, Kux ICS; Mills, Calenders, Mixers, Laboratory Presses, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

Wanted for export: used injection machines 4 oz. or better 8 oz. latest model, as well as used complete extruders 2 or 2½" if possible with molds and dies. Give all details, best possible prices and shortest delivery time. Reply Box C127, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Ethyl Cellulose, Acrylic and Vinyl Resin material. Submit samples and details of quantities, grades, and color for our quotations. Reply Box 508, Modern Plastics.

Wanted molding foreman to take full charge of injection molding department in new plant with 6 machines. Must know mold set-up and repair, machine maintenance & have good common sense. We offer the right man a secure position and excellent pay. Write your full background and experience. Box MPM 7938, 113 W. 42 St., N. Y. 18.

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One 150 Gal. per 8 Hr. Methyl Methacrylate Monmer Distillation Unit.

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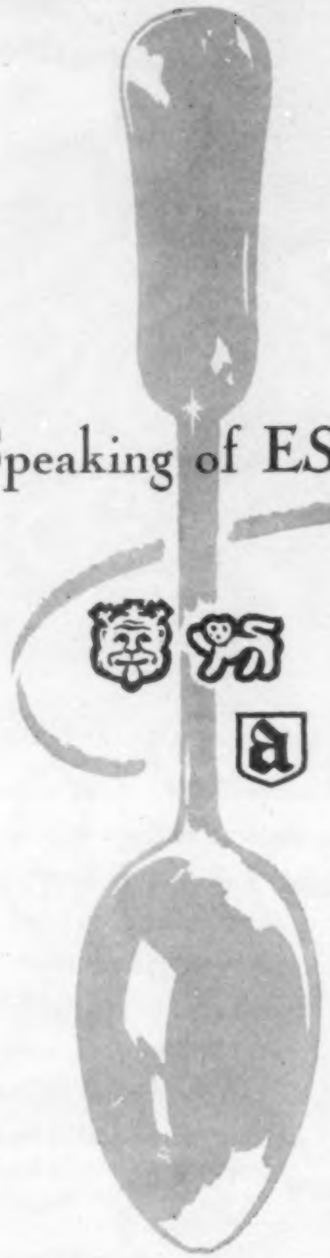

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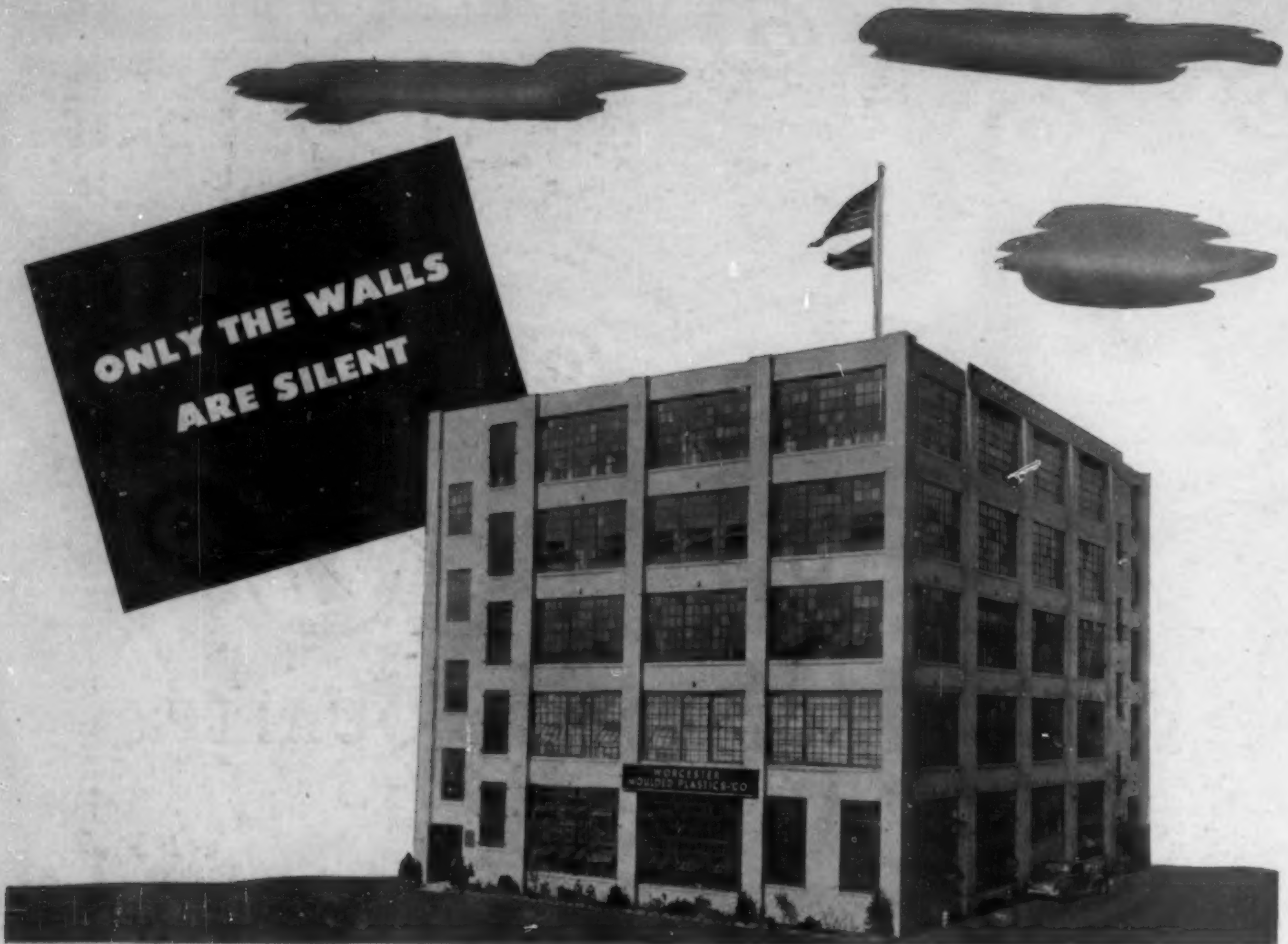

In this plant, modern as tomorrow, the doors never close. Inside there's a hustle and bustle 24 hours a day. Men and women are at work, yes — and at the right time just as hard at play, too. But their chief concern is production of custom injection moulded parts and products of plastics. Die making alone occupies one entire floor. Another space equally large is devoted exclusively to assembly, finishing and inspection. Every square inch of ground floor space is filled with moulding equipment, with just as much room again for the storage of raw materials. This, in essence, is your plant — your source of quality plastics in volume. In it an abundance of versatility is at your command. The doors are always open — TO YOU.

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The problem of making cream separator discs out of plastics —the first ever used—was solved by General Electric's *complete* plastics service for the Galloway Co., Inc., Waterloo, Iowa.

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